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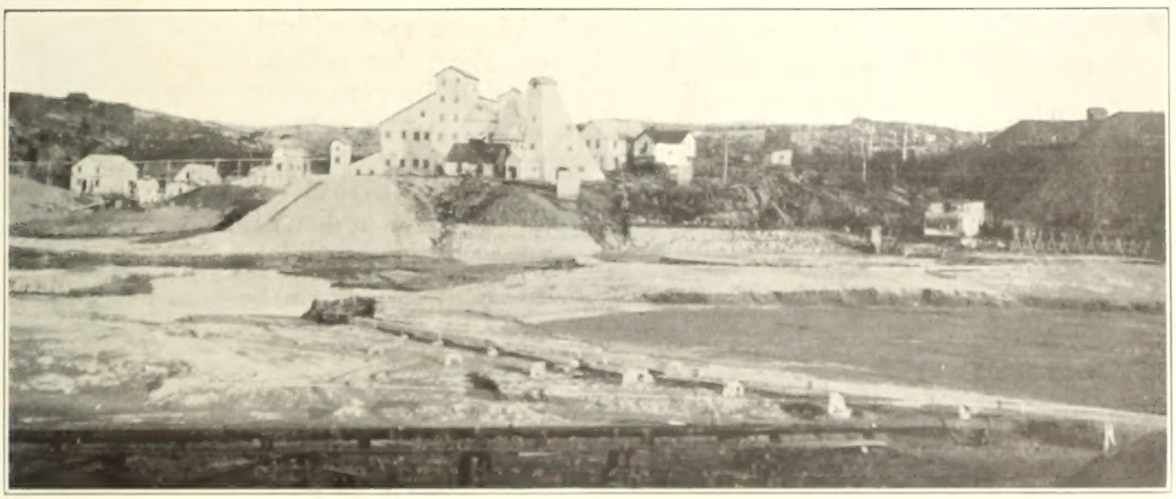
JULY 1, 1915 Single Copies 15 Cents

CANADIAN MINING JOURNAL

VOL. XXXVI TORONTO No. 13



A VIEW ACROSS THE RECENTLY EXPOSED BED OF COBALT LAKE

The Canadian Mining Journal, Purman Bldg., 263-5 Adelaide St. West, Toronto, Ont.

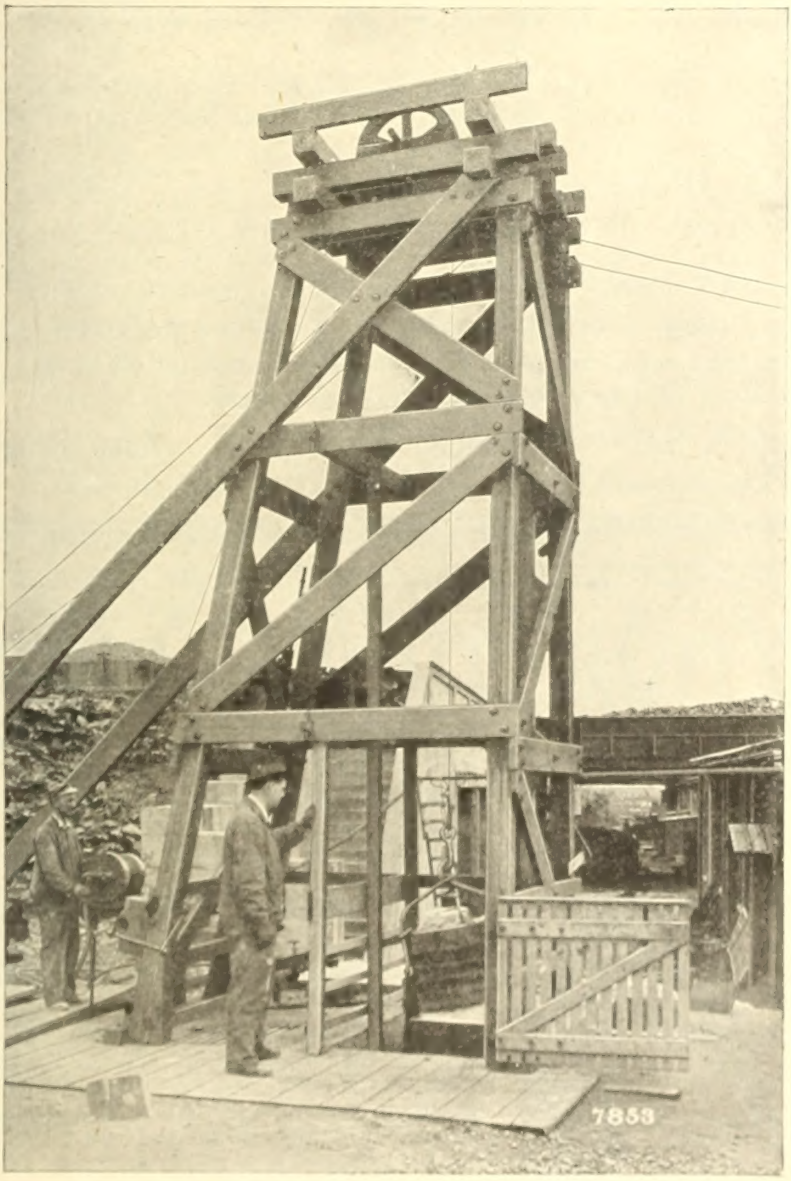
Elbert Hubbard's philosophy of advertising was positive and clearly crystallized.

"Advertising," he once wrote, is simply announcing to the world in an effective way where you are, who you are and what you have to offer in the way of human service or commodity. All live men are advertisers, and the only man who should not advertise is the man who has nothing to offer the world in the way of human service, and such a man is a dead one, whether he knows it or not.

"Advertising is a legitimate and ethical proposition. Life is too short for you to hide yourself away, mantled in your own modesty, and let the world hunt you out. Even the dead are advertisers, for on visiting a beautiful cemetery I noticed that on nearly every marble slab was given a list of the virtues, talents and beautiful qualities which the dead man was supposed to have carried in stock. This is what you call non-productive advertising from an emotional standpoint.

"Personally, I do not endorse it. Advertise while you are alive and send flowers to the man when he can appreciate them."

Have You Read Bulletin 4033 ?



If possible, we would place a copy of our **"LITTLE TUGGER" HOIST** bulletin in the hands of every mining man in Canada. We are certain that it is the most interesting booklet yet produced on the subject of hoisting, and that it will pay you to read it.

Send your address.

Operates by steam or by air.

Canadian Ingersoll-Rand Co., Limited

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OF THE HIGHEST QUALITY

made from special grades of Wire drawn to our specifications and carefully tested before being used. They are at work in all parts of Canada from Vancouver to Halifax and are everywhere recognized as the best on the market. Complete stocks held in all parts. Orders executed and quotations furnished by:

Nova Scotia: Wm. Stairs, Son & Morrow, Ltd., Halifax. **New Brunswick: W. H. Thorne & Co., Ltd., St. John.**
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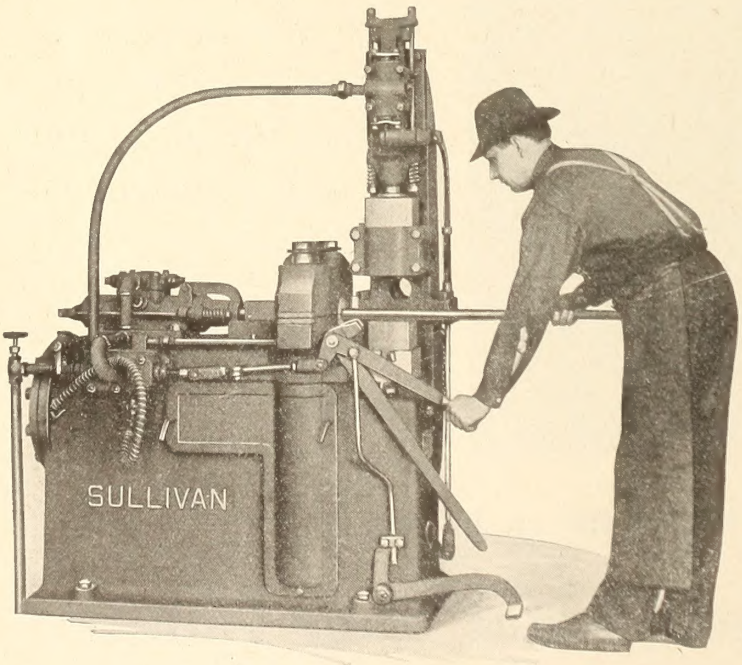
Highest Quality. Satisfaction in Use. Prompt Delivery. Keen Prices.

CABLES: "Ropery, Rutherglen." CODES: Western Union, A. B. C. (4th and 5th Editions), A.1., Liebers and Private.

HAMMER YOUR DRILL BITS



And Preserve the Quality of Your Steel

Hammer-forged bits retain all the toughness and strength you paid for in selecting a good grade of steel. They possess added refinement of grain and resistance to wear, due to the hammering process.

THE SULLIVAN SHARPENER

is an "all-hammer" machine. This picture shows it putting the spread or flare on the steel by upsetting it with rapid blows of a horizontal hammer. The steel is gripped in dies, by a powerful compressed air vise.

The wings and corners of the bit are *hammered* out under vertical swaging dies.

Sullivan Sharpened Bits cut faster and farther.

Bulletin 672.

Sullivan Machinery Company,

122 South Michigan Avenue
CHICAGO

The Minerals of Nova Scotia

The extensive area of mineral lands in Nova Scotia offers strong inducement for investment.

The principal minerals are:—Coal, iron, copper, gold, lead, silver, manganese, gypsum, barytes, tungsten, antimony, graphite, arsenic, mineral pigments, diatomaceous earth.

Enormous beds of gypsum of a very pure quality and frequently 100 feet in thickness are situated at the water's edge.

The Province contains numerous districts in which occur various varieties of iron ore practically at tide water and in touch with vast bodies of fluxes.

The Gold Fields of the Province cover an area of approximately 3,500 square miles. The gold is free milling and is from 870 to 970 fine.

Deposits of particularly high grade manganese ore occur at a number of different localities.

Tungsten-bearing ores of good quality have lately been discovered at several places and one mine has recently been opened up.

High-grade cement-making materials have been discovered in favorable situations for shipping.

Fuel is abundant, owing to the presence of 960 square miles of bituminous coal and 7,000,000 acres of woodland.

The available streams of Nova Scotia can supply at least 500,000 H.P., for industrial purposes.

Prospecting and Mining Rights are granted direct from the Crown on very favorable terms.

Copies of the Mining Law, Mines Reports, Maps and Other Literature may be had free upon application to

HON. E. H. ARMSTRONG,
Commissioner of Public Works and Mines,
HALIFAX, N. S.

PROVINCE OF QUEBEC

Department of Colonization, Mines and Fisheries

The chief minerals of the Province of Quebec are Asbestos, Chromite, Copper, Iron, Gold, Molybdenite, Phospate, Mica, Graphite, Ornamental and Building Stone, Clays, etc.

The Mining Law gives absolute security of Title and is very favourable to the Prospector.

MINERS' CERTIFICATES. First of all, obtain a miner's certificate, from the Department in Quebec or from the nearest agent. The price of this certificate is $10.00, and it is valid until the first of January following. This certificate gives the right to prospect on public lands and on private lands, on which the mineral rights belong to the Crown.

The holder of the certificate may stake mining claims to the extent of 200 acres.

WORKING CONDITIONS. During the first six months following the staking of the claim, work on it must be performed to the extent of at least twenty-five days of eight hours.

SIX MONTHS AFTER STAKING. At the expiration of six months from the date of the staking, the prospector, to retain his rights, must take out a mining license.

MINING LICENSE. The mining license may cover 40 to 200 acres in unsurveyed territory. The price of this license is Fifty Cents an acre per year and a fee of $10.00 on issue. It is valid for one year and is renewable on the same terms on producing an affidavit that during the year work has been performed to the extent of at least twenty-five days labour on each forty acres.

MINING CONCESSION. Notwithstanding the above, a mining concession may be acquired at any time at the rate of $5 an acre for SUPERIOR METALS, and $1 an acre for SUPERIOR MINERALS.

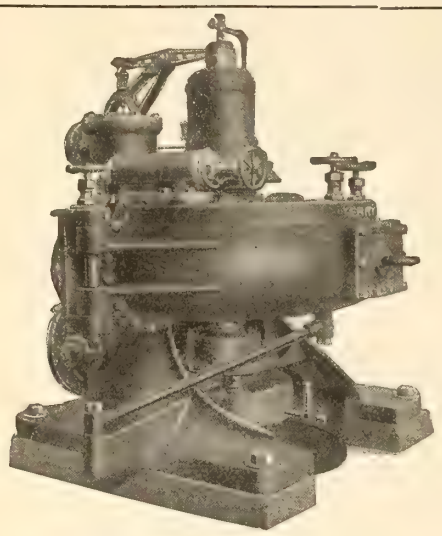
The attention of prospectors is specially called to the territory in the North-Western part of the Province of Quebec north of the height of land, where important mineralized belts are known to exist.

PROVINCIAL LABORATORY. Special arrangements have been made with POLYTECHNIC SCHOOL of LAVAL UNIVERSITY, 25 ST. DENIS STREET, MONTREAL, for the determination, assays and analyses of minerals at very reduced rates for the benefit of miners and prospectors in the Province of Quebec. The well equipped laboratories of this institution and its trained chemists ensure results of undoubted integrity and reliability.

The Bureau of Mines at Quebec will give all the information desired in connection with the mines and mineral resources of the Province, on application addressed to

THE HONOURABLE THE MINISTER OF COLONIZATION, MINES AND FISHERIES, QUEBEC.

When Inquiring Advertisers please mention The Canadian Mining Journal.



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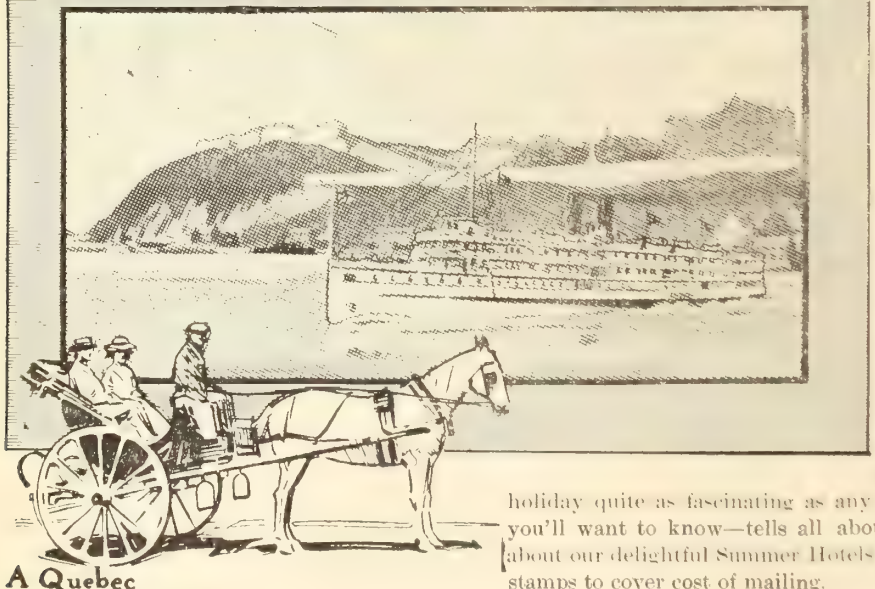

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To Montreal and Return . .	$25.00
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¶ All the charm of quaint old-world travel-haunts is reproduced in this city that stands guard over Canada. Yet Quebec is individual—distinctive—its "atmosphere" is all its own—its quaintness is of a quality that holds the interest even more surely than the Europe that was America's "Mecca" of travel. So you can come to this grand old town, with a certainty of enjoying a holiday quite as fascinating as any you ever had abroad. Our book tells all you'll want to know—tells all about our famous Niagara-to-the-Sea trip, and about our delightful Summer Hotels at Murray Bay and Tadousac. Send 6c in stamps to cover cost of mailing.

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DODGE SPROCKET WHEELS

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Our Foundry and Machine Shops are large and modern, send in your specifications for prices.

COMPLETE CATALOGUE ON REQUEST

DODGE MANUFACTURING CO., LTD.

TORONTO MONTREAL

Synopsis of Coal Mining Regulations

COAL mining rights of the Dominion, in Manitoba, Saskatchewan and Alberta, the Yukon Territory, the North-West Territories and in a portion of the Province of British Columbia, may be leased for a term of twenty-one years at an annual rental of $1 an acre. Not more than 2,560 acres will be leased to one applicant.

Application for a lease must be made by the applicant in person to the Agent or Sub-Agent of the district in which the rights applied for are situated.

In surveyed territory the land must be described by sections, or legal sub-divisions of sections, and in unsurveyed territory the tract applied for shall be staked out by the applicant himself.

Each application must be accompanied by a fee of $5 which will be refunded if the rights applied for are not available, but not otherwise. A royalty shall be paid on the merchantable output of the mine at the rate of five cents per ton.

The person operating the mine shall furnish the Agent with sworn returns accounting for the full quantity of merchantable coal mined and pay the royalty thereon. If the coal mining rights are not being operated, such returns should be furnished at least once a year.

The lease will include the coal mining rights only, but the lessee may be permitted to purchase whatever available surface rights may be considered necessary for the working of the mine at the rate of $10.00 an acre.

For full information application should be made to the Secretary of the Department of the Interior, Ottawa, or to any Agent or Sub-Agent of Dominion Lands.

W. W. CORY, Deputy Minister of the Interior.

N.B.—Unauthorized publication of this advertisement will not be paid for.

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We wish to draw the attention of mining, metallurgical, and development corporations to our excellent facilities for compiling, arranging, illustrating, printing and distributing Annual Statements, Special Reports, Descriptive Pamphlets, etc.

We guarantee our work in all respects. In letter-press, half-tone engravings and reproductions in colour, we are prepared to give entire satisfaction.

We shall be glad to furnish estimates to enquirers.

ADDRESS

Industrial and Technical Press Ltd., 263-5 ADELAIDE ST. WEST, TORONTO

OR

Canadian Mining Journal, 263-5 ADELAIDE ST. WEST, Toronto

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We are in a position to supply you with your requirements in all lines of Machinery and Supplies.

Sullivan Diamond Drills, Compressors, Rock and Hammer Drills, Hoists, Boilers, Ore Cars, Buckets, Drill Steel, Drill Sharpeners, Shafting, Transmission and Conveying Material.

Hoisting Cable, Screens, Iron Pipe and Fittings, Valves, Building Supplies, Camp and Kitchen Supplies, General Line Light and Heavy Hardware.

We will be pleased to have your specifications and to quote you on your requirements.

"IT WILL PAY YOU TO GET OUR PRICES."

Our Large Stock Guarantees You the Most Prompt Delivery on All Orders.

NORTHERN CANADA SUPPLY CO. LIMITED

COBALT PORCUPINE TIMMINS

Milling and Mining Machinery

Shafting, Pulleys, Gearing, Hangers, Boilers, Engines, and Steam Pumps, Chilled Car Wheels and Car Castings, Brass and Iron Castings of every description, Light and Heavy Forgings.

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A state institution offering engineering courses leading to the degree of Engineer of Mines. Located in the Lake Superior mining district. Mines and mills accessible for college work. For Year Book and booklet of views, address President or Secretary.

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There are many millions of acres in Eastern, Northern, and Northwestern Ontario where the geological formations are favorable for the occurrence of minerals, the pre-Cambrian series being pre-eminently the metal-bearing rocks of America.

The phenomenally rich silver mines of Cobalt occur in these rocks; so also do the far-famed nickel-copper deposits of Sudbury, the gold of Porcupine and Kirkland Lake, and the iron ore of Helen, Magpie, and Moose Mountain.

Many other varieties of useful minerals are found in Ontario:—cobalt, arsenic, iron pyrites, mica, graphite, corundum, talc, gypsum, salt, petroleum, and natural gas.

Building materials, such as brick, lime, stone, cement, sand and gravel, are abundant.

The output of the mines and metallurgical works of Ontario for the year 1913 was valued at $53,232,311. Ontario has the largest mineral production of any of the Provinces.

The prospector can go almost anywhere in the mineral regions in his canoe; the climate is invigorating and healthy, and there is plenty of wood and good water.

A miner's license costs $5.00 per annum, and entitles the holder to stake out three claims a year in every mining division.

For maps, reports of the Bureau of Mines, and mining laws, apply to

HON. G. H. FERGUSON,
Minister of Lands, Forests and Mines,
Toronto, Canada.

Dominion Coal Company

Limited

Glace Bay — Nova Scotia

19 Collieries
Output—5,000,000 tons annually

"Dominion" Coal
Screened, run of mine and slack

"Springhill" Coal
Screened, run of mine and slack

Collieries at Glace Bay, C.B., and Springhill, N.S.

Shipping Ports—Sydney and Louisburg, C.B., and Parrsboro, N.S.

For Prices and Terms Apply to:

Alexander Dick, General Sales Agent,
112 St. James Street, Montreal

or at the offices of the Company at
171 Lower Water Street, Halifax, N.S.

and to the following Agents
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For Calendar of the School and further information apply to The Secretary, School of Mining, Kingston, Ontario.

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PLUMB PNEUMATIC JIG

MANUFACTURED IN MONTREAL

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Shot - High and low carbon.

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Two sizes:
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ELECTROLYTIC NICKEL 99.80%

Our metal is prime for the manufacture of Nickel Steel, German Silver, Anodes and for all remelting purposes, and is produced as rods, sheets, strip stock, wire and tubes.

Send inquiries direct to us

The International Nickel Co.
43 Exchange Place — New York

MONEL METAL

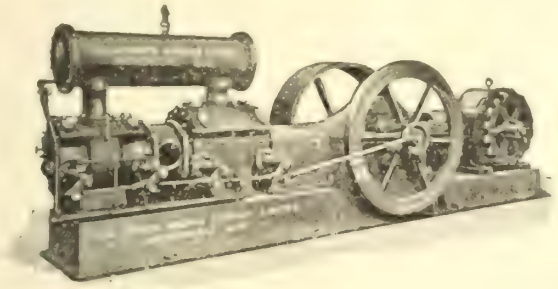
We are Sole Refiners of this natural, stronger than steel, non-corrosible alloy. Produced as rods, flats, castings, tubes, sheets, strip stock and wire.

AIR COMPRESSORS

¶ Do you know how much air your compressor is furnishing?

¶ Most compressors are rated too high, many sources of loss of power being ignored.

¶ If you wish to obtain a definite quantity of compressed air at the least cost for power and maintenance, use a JENCKES compressor.



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Works at:
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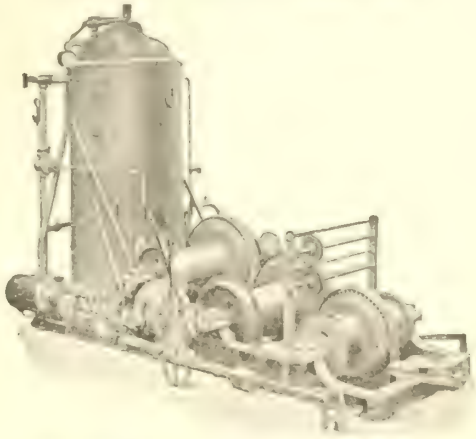
Hoists, Clamshells, Derricks and Material Handling Equipment of every description.



Standard Two Drum Hoist with Swinger

Engines for every kind of hoisting duty.
"BEATTY PLANT" on your work means uninterrupted service and complete satisfaction.
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Your enquiries will be appreciated.

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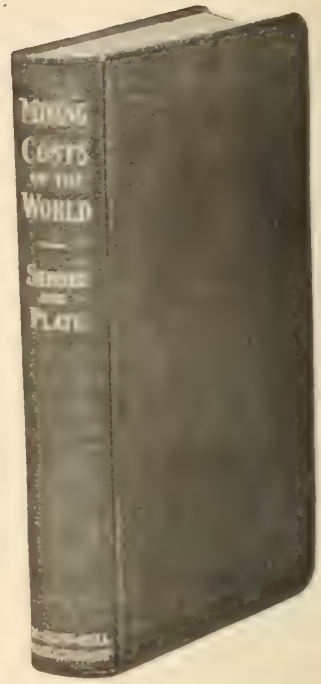
MINING COSTS OF THE WORLD

By EDMOND NORTON SKINNER, Ph. B., E. M. and H. ROBINSON PLATE, Mining Engineer.



An Engineer's and an Operator's Pocket Book giving the production costs and operating data of about 325 of the principal metal mines of the world. It is the first book to cover the field in such an extensive manner.

It contains a thorough compilation of operating results taken from the annual reports of mining companies and other reliable sources.

It is an invaluable reference work for Engineers, Managers, Superintendents, Operators and Students; affording as it does, cost data on the principal mining districts of the world.

The data cover a period of two to four years and are arranged in brief, convenient form.

400 pages, 5 x 7¼, flexible leather, 9 maps, $5.00 (21s) net, postpaid.

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Proprietors, Miners and Shippers of SYDNEY MINES BITUMINOUS COAL. Unexcelled Fuel for Steamships and Locomotives, Manufactories, Rolling Mills, Forges, Glass Works, Brick and Lime Burning, Coke, Gas Works, and for the Manufacture of Steel, Iron, Etc. COLLIERIES AT SYDNEY MINES, CAPE BRETON.

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SPECIAL ATTENTION PAID TO MINERS' REQUIREMENTS. CORRESPONDENCE SOLICITED.

Steel Works and Head Office: NEW GLASGOW, NOVA SCOTIA

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Producers of Refined Silver

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Established 1875

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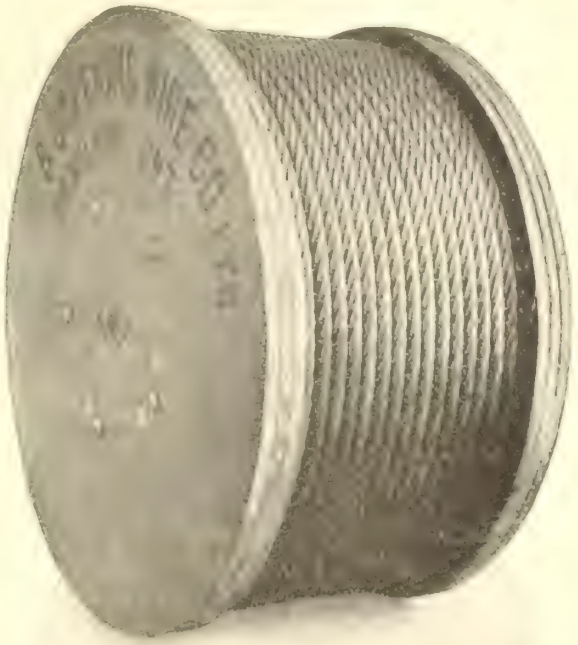

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CRUCIBLE CAST STEEL, BEST PLOW STEEL, ACME BRAND.

WIRE ROPE FITTINGS WIRE ROPE GREASE

The B. GREENING WIRE COMPANY, Limited

HAMILTON, ONT. MONTREAL, QUE

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3 SPECIALS. GUARANTEED TO GIVE EXCELLENT SERVICE.

IMPERIAL GENUINE The highest grade of Babbitt Metal. Manufactured expressly for all bearings carrying extremely heavy loads.

HARRIS HEAVY PRESSURE [illegible] BABBITT METAL WITHOUT A FAULT

ALUMINOID Specially [illegible] and light speed machinery

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TORONTO MONTREAL WINNIPEG

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Especially designed for Mines, Quarries and Contractor's work, such as Pile Driving, Bridge Building, and general Construction work.

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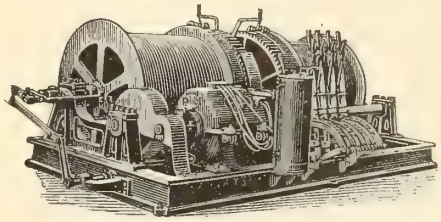

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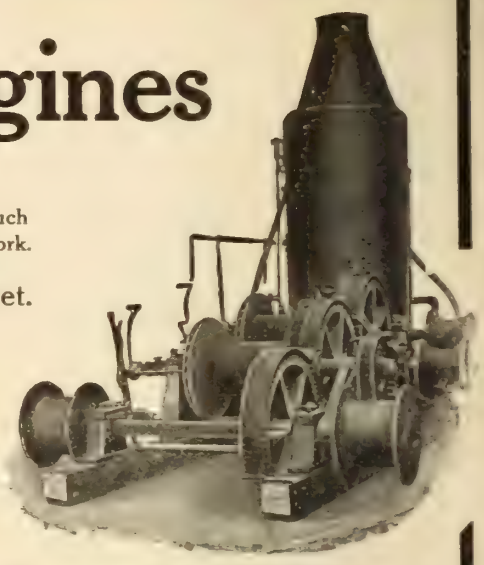

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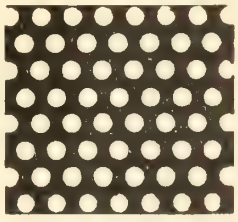

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For Every and All Purposes in all Metals

Elevator Buckets (plain and perforated).
Conveyor Flights and Trough, also
General Sheet Iron Work.

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The Largest Manufacturers of Surveying and Drawing Instruments in the world.

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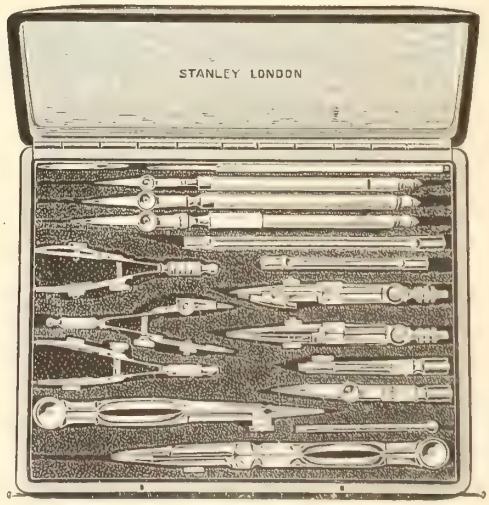

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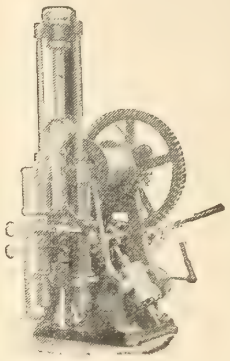

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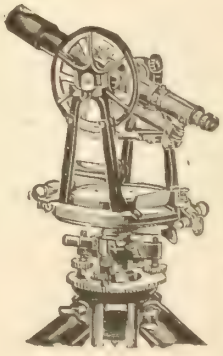

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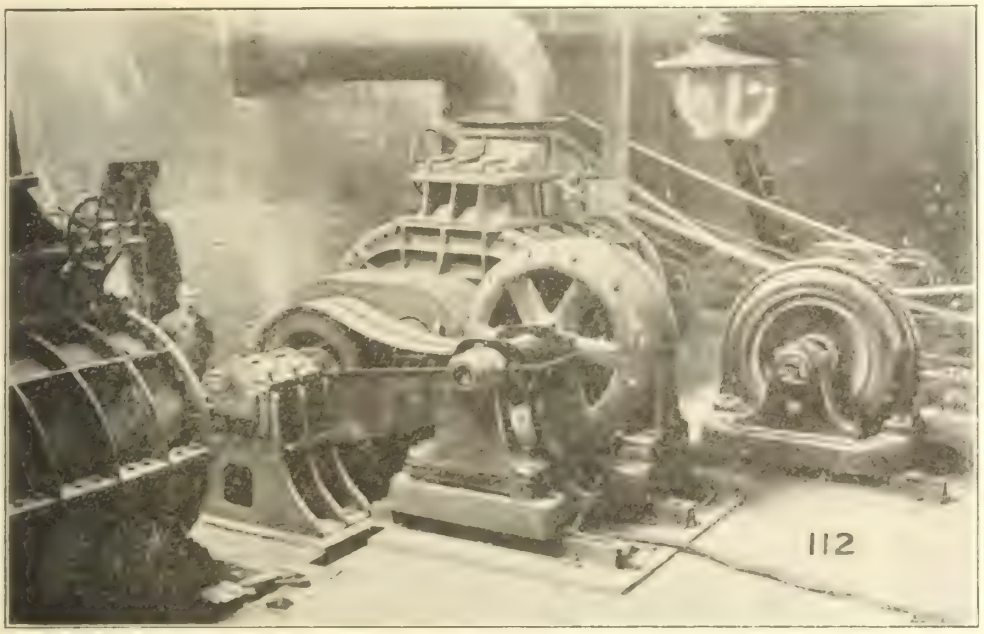

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THE CANADIAN MINING JOURNAL

VOL. XXXVI. TORONTO, July 1, 1915. No. 13

The Canadian Mining Journal

With which is incorporated the

"CANADIAN MINING REVIEW"

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REGINALD E. HORE

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CIRCULATION

"Entered as second-class matter April 23rd, 1908, at the post office at Buffalo, N.Y., under the Act of Congress of March 3rd, 1879."

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TREATMENT OF ZINC AND COPPER ORES

Following the visit of a Commission on Copper and Zinc Refining to British Columbia there have been numerous reports from Ottawa intimating that refineries will soon be established in Canada. The published news items are not in close accordance with the facts and are unauthorized. The Commission has not yet prepared its report.

It is the present practice of Canadian mining companies to smelt copper ores and concentrate zinc ores in this country and to ship the smelter products and the concentrates to the United States for further treatment. Such practice has been adopted as the best under the conditions. If, therefore, we seek, for patriotic or other reasons, to change the practice, we should first change the conditions.

There are obvious disadvantages in the present arrangement. The price of metals has risen so sharply in the last few months that producers are making every effort to increase output. The mine output can be greatly increased; but soon the smelting and refining plants will be severely taxed. Then the ore producer may look for further increase in charges and for refusals to accept shipments. It is natural that the smelters and refineries should take advantage of their improved position and endeavor to get a big slice of the profit now being made on metals. The ore producer under the present conditions is severely handicapped by the practice which under normal conditions he believes to be best.

That it would be a great boon to the Canadian mining industry to have at this time plants for the complete treatment of all ores mined in Canada is beyond question. It is probably because of the realization of this that the newspapers are printing so many despatches to the effect that it is [illegible] accomplished fact. It is difficult, however, to determine the grounds for such confidence. No [illegible] to govern metal regulations or company plans has [illegible] announced.

PETROLEUM AND NATURAL GAS

The Mines Branch has issued the first volume of a report by [illegible] on Petroleum and Natural Gas Resources of Canada. The subjects are [illegible] and are authoritatively presented. A second volume will be devoted to the occurrence of petroleum and natural gas in Canada.

The first volume contains chapters on the history, geographical occurrence and production, properties of petroleum; properties of natural gas, geological occur-

rence; preparation for development; methods of obtaining petroleum and natural gas; pumping, storage and transportation; utilization; conservation; and bibliography.

The report has been contributed to by M. R. Campbell, J. H. Gardner, Ralph Arnold, V. R. Garfias, Forrest M. Towl, T. T. Gray, Roswell H. Johnson, and L. G. Huntley. Dr. A. W. G. Wilson prepared the report for publication.

Outside of the Western Ontario field, Canada has few producing oil wells. Previous to the discovery of oil at Calgary there was little public interest in the oil industry and comparatively few technical men had occasion to work in Canadian oil fields. The revival of interest showed that very little information was available. The need for a monograph was apparent, and the Mines Branch is to be congratulated on its effort to gather and disseminate useful information on the oil and gas resources of the Dominion.

Complaint having been made to the authorities that the Britannia Mining and Smelting Company, operating in Vancouver mining division of British Columbia, was employing alien enemies, the Provincial police made enquiries and found that the company had discharged all Austrians and Germans from its employ except three Austrians who were injured while working for the company. In a report to the authorities the company says that it feels under a moral obligation to take care of these injured men, and will not discharge them unless ordered to do so. Two of the men were injured in the recent slide at the Britannia mine, and the other lost the sight of an eye while working for the company.

Such action on the part of the company is to be commended. Those who complained to the authorities may believe that their action was patriotic; but most Canadians will fail to agree with them. Humane treatment of employees must not cease because we are at war.

The medal of the Institute of Mining Engineers, London, will be awarded to Dr. J. S. Haldane. Dr. Haldane has rendered great service to mining, especially with reference to gases in coal mines. He was sent to the front immediately after the Germans began to use poisonous gases and has apparently been successful in providing means of rendering the gas less harmful.

The appointment of Mr. D. A. Thomas, the Welsh coal mine operator, to represent Great Britain in the purchase of arms and ammunition in Canada and the United States will be welcomed by mining men in America. Mr. Thomas has large interests here, besides his interests in a dozen important coal and iron companies in the Old Country. He is regarded as one of the leading business men of Great Britain.

During the past week the British War Office has come in for considerable criticism for showing anxiety over the supply of spelter. It was said that an opportunity for cornering the market in the United States was thereby created. The subsequent announcement that the War Office's requirements for some time are covered, indicates that the critics were unnecessarily alarmed.

The decision of the Butte miners' union to withdraw from the Western Federation and repudiate the contract between those organizations, is accompanied by the statement that the union paid $1,000,000 to the Federation and received no benefit whatever. The members of the union have, however, the consolation of knowing that no one else, excepting always the Federation officers and hirelings, has benefited.

The announcement of dividend increases is becoming a common feature of copper mining company reports these days.

The demand for nickel and copper is making itself felt in the Sudbury district. The improvement since last September has been tremendous.

IRON AND MACHINERY PRICES ADVANCE.

The heavy buying of railway equipment by Russia and France, the continued heavy demand for munitions, the moderate improvement in strictly domestic demand for nearly all iron and steel products and the prospect for the development of a large amount of business of various kinds in the near future have added very materially to the decided improvement in conditions recently noted. In the case of the three leading rolled products, steel bars, plates and structural shapes, the Steel Corporation and several of the largest independent concerns have advanced quotations $1 per ton and are so well supplied with orders for the next three or four months that they are not seeking business for that period. It is also true that for delivery during the last quarter of the year, mills are extremely conservative in adding to their bookings.

In the pig iron market activity has been confined largely to basic, for which some orders have been placed in the Philadelphia and Pittsburgh districts. Although the foundry iron market is very quiet at present, sellers are confident that they will soon enjoy some of the improvement which is coming to the finished material market. Merchant stacks report that specifications are going forward satisfactorily.

As a natural result of the continued heavy demand for certain machine tools, especially lathes and screw machines, prices on these machines have again been advanced about 10 per cent. and prices are now approximately 20 per cent. higher than they were when war was declared. It is expected that at an early date prices on nearly all other machine tools will be advanced about 5 per cent. Wages are being advanced by machine tool manufacturers. Many plants are being operated overtime and are finding it impossible to deliver machines as rapidly as demanded by customers. —Iron Trade Review.

Dome Mines, Ltd., has been listed on the New York and Toronto Stock Exchanges

COAL MINING AND THE WAR

At the end of February the number of persons from Great Britain's coal mines who had joined H. M. Forces was 191,170, according to a Departmental Committee appointed to inquire into the conditions prevailing in the coal mining industry due to the war. That the number is now much larger is beyond doubt. The coal miners are doing their share of the fighting at the front and doing it nobly.

But the enlistment of so many men for service has embarrassed the mine operators. The committee finds that from returns representing 89 per cent. of the total labor employed in coal mines that the net decrease in mine labor at the end of February amounted to 134,186 persons, or 13½ per cent. of the persons employed in July, 1914, and that there has been, over the seven months, August, 1914, to (and inclusive of) February, 1915, as compared with the corresponding months twelve months earlier, an average fall in output of 3,044,329 tons (or a total loss in output of 13½ per cent.), which loss will continue unless means are taken to prevent it.

The following are extracts from the report:

"We find also that absence from work over all classes of mine workers, on the days on which the mines were open to work, was, for the seven months preceding the war, an average of 10.7 per cent., and for the seven months succeeding the outbreak of war, an average of 9.8 per cent.; and we have arrived at the conclusion that fully 4.8 per cent. of this is avoidable absence. The absenteeism, taking the coal-getters only, is very much higher. And that were there no avoidable absenteeism, the output would be increased to the extent of between 13 and 14 million tons; but perfection in this respect is not to be expected. We believe, however, that the case has only to be put before the miners in order to secure a great response on their part, and we suggest that the body best fitted in all respects to put forward the case is the Executive of the Miners' Federation of Great Britain. We suggest, also, that the question of the curtailment of holidays and 'stop-days' during the war might receive the attention of the same body.

"It is not possible to determine the exact extent of the home demand without very far-reaching enquiry; and indeed, it is very doubtful whether it is determinable, but from the evidence before us and the enquiries we have instituted, we incline to the belief that it is not far from what it is in normal times.

"The loss in production, for the year commencing from the outbreak of the war, will, unless means are taken to reduce the loss probably amount to 30 million tons, against which must be put a probable reduction in the quantity of coal exported of 24 million tons, leaving a net shortage of 12 million tons. But if the miners continue to be recruited for the Army the deficiency will be increased. The evidence before us is conclusive that if labor is further withdrawn from the collieries [illegible] the adoption of all possible ameliorating measures the output will be so reduced as to seriously affect the industrial position of the country, and the time appears to the Committee to have arrived when very full consideration should be given to the question as to whether further recruiting among the miners should be discouraged.

"With reference to the Eight Hours' Act, we suggest that the owners and workmen should confer together and determine to what extent, if at all, the Act should be suspended in individual districts, i.e., to what class of labor the suspension should apply, and the amount in point of time the suspension should cover.

"We do not advise that women should be employed to a greater extent than at present on the surface of mines.

"We do not suggest that the age limit at which boys can be employed below ground or on the surface should be reduced.

"We have indicated certain directions in which, possibly, internal reorganization in the mines might be further carried out.

"If the restriction of the export of coal to neutral countries is found to be advisable, we have pointed out that special consideration should be given to those mining districts which to a large extent depend on export for the existence of the collieries.

"We think that the importance of economy in the use of coal should be brought before the public. Savings which at once occur to the mind are economies in public and private lighting, whether by gas or electricity, and the manufacture of luxuries which require coal. The rise in the price of coal will no doubt create a tendency towards economy, but we believe that a considerable further saving could be effected if it were brought home to the public that it is a patriotic duty to economize coal during the period of the war.

"The basis of all the proposals and suggestions made by the Committee is harmonious co-operation between employers and employed through the medium of the organizations on both sides thoroughly representative of the parties. Unless the organizations possess this power and are able to act with authority for both owners and workmen, friction may arise and stoppages of work take place which ought to be avoided at the present time to the utmost extent possible.

"In the highest interests of the nation it is especially desirable that during the period of the war the employers should co-operate with the representatives of the workmen on such questions as non-unionism, or other questions likely to lead to any friction or stoppage during the present unprecedented circumstances."

ALIEN ENEMIES AT SUDBURY.

Under the caption "Enemies of the King" the Sudbury Mining News prints the following:—

"It is understood that steps are being taken to round up all aliens in the Sudbury district. It is a mystery why this has not been done before, for it is well known [illegible] pretty much as they please, and evidently think that the Canadians are a pretty easy-going lot. For example, [illegible] were murdered, a gang of Austrians held a big celebration, and as no person here had authority to arrest and [illegible] regulations governing alien enemies are going to be enforced [illegible] all register, especially the ones who hold the high post[illegible]

The directors of the Consolidated Mining and Smelting Company of Canada, Ltd., have declared a dividend of [illegible] payable July 1.

WHAT AMERICANS THINK OF GERMANY

By an American Mining Engineer.

An Englishman who recently visited the United States declared that in all London there is not a man who understands America. "And," he continued, "no one understands it. It is too varied, too big, too rapid in its transitions." Of one thing I am sure, the average British newspaper understands America not at all. The news items which they cull from American papers for reprinting in England are one-sided, sensational, and altogether misrepresentative. Like any other country, America is a lot of things at once, with dozens of angles and facets, and it is altogether misleading to select one phase of national life, perhaps a derogatory one, and say that that is the entire nation. Any Englishman would laugh at any foreigner who thought he understood all about England from the reading of a few sensational articles extracted from London's press.

As to what the people of the United States, its one hundred million population, think and feel about the war, about the Germans, about Belgium, about the British and the French, there is one great and significant fact to be taken into consideration. The Americans are not fools! They know what has been going on since last July, are remarkably well informed on every point, and have been deceived not at all. The elaborately prepared German propaganda, of which so much has been heard, has accomplished nothing, nor changed American ideas a particle. To an amazing degree, the whole pro-German defense of her policies and acts has been ignorant, ill-advised, and in the poorest kind of taste. "They have not even caught a glimmer of the American point of view," says the discerning weekly, "Life," of New York.

But why, asks the average Britisher, did not America make a formal protest at Germany's outrage of Belgium, since the United States was one of the signers of the Hague Treaty, which guaranteed the inviolability of the little buffer country? The answer is that it was expressly stated in the same treaty that "under no consideration" was the United States expected to forsake its traditional policy of non-interference in Europe's internal quarrels. America has always made a particular effort to keep free of dissensions, policies, and entanglements which concerned the countries of Europe alone. Such is the natural and logical attitude of a young, growing nation with the ideals and ideas of the U. S. A.

There are among America's one hundred millions of people, a few Germans (not very many) who are Germans first and Americans second. These few are noisy, active, and, for the most part, grossly offensive, and are regarded as such. Ninety-nine and a good-sized fractional per cent. of the population are Americans, first, last, and all the time; thinking and acting as Americans, not as Germans. President Wilson (who by the way thoroughly understands the American people) was right when he said that he relied for support for his measures, not on the noisy few, but on the great mass of quiet, thinking, intelligent men, who in other countries would be styled the middle class, but are very nearly the whole class under the Stars and Stripes.

This great mass of quiet, thinking Americans is the real America, the America that counts. It has thought about the war a good deal. Its thinking is going to have vast and far-reaching effects in the years to come. And it is going to have a bad, a very bad, effect on Germany, the German people, German schools of thought, German trade and influence, German hopes, desires, and aspirations. The quiet, considered hostility of a great, wealthy, progressive nation with whom friendliest terms formerly existed is no small matter. Germany will learn this as time goes on.

The United States has long been accused of "dollar-chasing" and of caring only for profits and dividends. Partly, this is true, due to the tremendous efforts necessary to make a great and growing population comparatively comfortable over a vast area bristling with exceptional natural difficulties, where long distances, severe climate, and high mountains exacted unusual material effort. But there are other sides to the national character besides dollar-chasing. There is much keen, discerning common-sense, a capacity for understanding other peoples and nations, a strong feeling against autocratic "you-must-do-this-or-that," and a surprising amount of hidden sentiment which ultimately manifests itself in an unmistakable way.

Nearly every American reads the newspapers, he is well informed, he is relatively prosperous; beneath his practical, material exterior lies an amount of sentiment that is no less powerful because it is normally quiet. This undercurrent of feeling and thought constitutes that potent force which indirectly governs America—public opinion.

After the war Germany will reap a harvest of hate. America will furnish part of it. Where formerly was a good-natured tolerance, a certain amount of admiration, and a respectful friendship in business, education and generalities, there have loomed up an overwhelming dislike and a vast disgust. In the most telling and extraordinary manner, Germany has taken in every one of her acts since the first whisperings of war, the very step to sink her fathoms deep in American distrust. By explaining and excusing these acts, she has but still further stained herself, saying exactly the wrong thing in the wrong way, and has antagonized every decent instinct of the American people.

America believes in public opinion. The United States is governed largely by public opinion, and puts a great trust in its ultimate efficacy. Germany will realize for many years what she has lost in American public opinion. It will count against her in numberless unseen ways.—P. B. McD.

RUSSIAN PETROLEUM.

According to "The Petroleum Review," the idea of forming a petroleum state monopoly in Russia has been abandoned, and in its place there is now under investigation the question of forming a shareholders' company composed of the main producing firms in the Baku district with the participation of the state.

The interest of the Russian State in petroleum is very wide, the state appearing not only as the owner of large petroliferous areas in various parts of the Russian Empire, but also as the owner of enormous natural reserves of oil on the now well-known percentage basis. This is formed of a levy in kind on the production of areas owned by the state, and leased by the latter to the producers against payment in kind. The state is also a consumer of very large quantities of petroleum products, and therefore the interest of the State in the petroleum production is considerably wider than the simple regulation of the production itself. The consumption of fuel alone by the state railways amounts to about 80,000,000 poods a year.

COPPER MINING IN ONTONAGON COUNTY, MICHIGAN

The improvement during the past few months in the price of copper is being felt in the copper mining camps throughout America. The brisk demand for the metal lends special interest to the opening of new properties and the reopening of old ones. Copper is being sold months ahead by many of the large producers and great efforts are being made to increase production. In spite of these efforts the demand shows no sign of abating. On the contrary the price seems more likely to rise than to fall.

The Michigan copper mining district is now experiencing great prosperity as the result of the improved conditions. This is especially so in Houghton county, where are located such well known mines as the Calumet & Hecla, Tamarack, Osceola, Wolverine, Centennial, Baltic, Champion, Superior, Quincy, Trimountain, Franklin and Isle Royale. Unusual interest attaches, however, to recent developments in Ontonagon county, where the ore deposits are more varied in character and where the operating difficulties are many.

During the past few years the returns from mining operations in Ontonagon county have been meagre. Years ago profitable operations were carried on there, and conditions at pesent promise well for a revival of prosperity. In the old days the Minesota mine made Rockland one of the bright spots in Northern Michigan and gladdened the hearts of shareholders with "richness." The Minesota Mining Company paid $1,820,000 in dividends. Other operators were less fortunate, and, although several lodes have been opened, no other mining companies operating in the county have taken a place on the list of dividend payers. Profits are, however, now reasonably anticipated by some of the operators.

During the past decade Ontonagon has figured as a copper producing district chiefly because of the operation of the Michigan, Mass, and Victoria mines. Development work has been actively carried on at several properties, notably at the White Pine and Lake. The Michigan is considered worked out and was closed down a few years ago. Mass and Lake were closed down in 1913 and 1914 during the Western Federation strike. Victoria has been operating continuously but the low grade of its ore has prevented a profit being made when the price of copper is low. At the White Pine exploration and development work has been carried on steadily, and the mine now is for the first time a producer.

The White Pine is isolated from the other Michigan copper mines, and its ore is of a different character. Its entry on the list of producers is an event of considerable importance. Some notes on the developments of mines in Ontonagon county may therefore be of interest.

Early Mining in Ontonagon County.—M. Charles E. Wright in his report as Commissioner of Mineral Statistics Michigan, 1880, gives the following account of early mining in Ontonagon county:

"The first great impetus given to the mining interest in this county was through the discovery of the Minesota mine in 1847 by Mr. S. O. Knapp. He was led to the discovery by examining the indentations which were plainly discernable along the surface outcrop of the vein and which proved to be ancient mining excavations. This was the first discovery of the "Indian diggings" which have since been found to exist everywhere in the copper region. One of the principal pits opened by Mr. Knapp was found to have penetrated the vein to a depth of 27 ft., and was filled up with an accumulation of dirt and partially decayed vegetation. At 18 ft. from the surface a mass of nearly pure copper was found, weighing upwards of six tons. This mass had been raised from its original bed, a distance of 5 ft., and secured there on timbers, which had been placed under it. The timbers, however, had decayed, and the mass remained in its place, supported by the soil which had imbedded itself around it. The mass had been hammered all over until its surface was entirely smooth and the adhering gangue, or rock crystals, was almost wholly removed. In this pit, as in others which cleared of the rubbish which filled them, were found great numbers of stone hammers, bits of burnt wood, a copper chisel with a socket for holding a handle, etc. Directly over this mass, deriving its support from the soil and debris which nearly filled the pit, stood a hemlock, which showed, when cut, 395 distinct annual rings of growth; and this was standing by the side of a much larger stump of a tree that had grown up and gone to decay since this pit had been excavated, and the mass of copper found beneath its roots had been raised from its bed, and the brands which were found beneath it had been burned, and the long period of time had elapsed necessary for the accumulation of the soil that filled the pit and supported the organic growth.

"The rich promise afforded by the discovery of this mass of copper was greatly increased by the speedy results which further explorations immediately developed, and was subsequently in the highest measure fulfilled in the abounding prosperity of the company.

"Four years later the National Mining Company began its prosperous career, and opened its mine on the adjoining location. These two companies, among the most profitable mining enterprises ever organized on Lake Superior, gave to the Ontonagon mineral district a wide celebrity, and for nearly twenty years it enjoyed a comparatively high degree of material prosperity."

The successful operation of the Minesota mine naturally led to the exploration of neighboring properties. The ore-bearing veins were found to extend for several miles, and copper in promising quantities was found in many places. Many companies were formed and several lodes were opened up. In some cases mining was extensively carried on; but after temporary successes nearly all such operations in Ontonagon county resulted in losses. Besides Minesota and National a regular production was made in the fifties by the Adventure, Aztec, Bluff and Ridge mines. Later the Mass, Belt, Evergreen, Knowlton, Ogima, Victoria and Lake appeared as producers.

The Mass Consolidated Mining Company owns a range from which is removed by several openings an amygdaloid lode known as the Baltic Lode. Ogima and Knowlton. During the past few years the flatter vein has been extensively developed and the mine put into shape to produce a large tonnage. Under present prices this ore should yield handsome profits.

The Mass has been put into good shape by Superintendent E. W. Walker and but for the strike of 1913 could probably have begun to reap the rewards for

their expenditures before the war. It has been a long struggle against odds.

In 1912, the last full year of normal operations, the Mass mine produced 132,891 tons of ore yielding 2,045,006 lb. of copper, an average of 15.39 lb. per ton. During the last five months of the year the cost per lb. averaged 14.46 cents, and President J. W. Linnell was led to conclude that during 1913 profits would be obtained. The labor conditions during 1913, however, made it impossible to operate economically and the mine was closed down. It had been demonstrated, however, that the property is a good one. Given a fair chance, the Mass mine should now easily live down its past and take rank with the profitable producers.

The Victoria Copper Mining Company has been for several years producing low grade ore at low cost; but, until recently, not making money. The mine is unfortunately located as regards railroad facilities. On the other hand very cheap power from the Ontonagon river is available, a Taylor hydraulic compressor plant having been installed some years ago.

The Victoria mine produced in 1912, 131,955 tons ore, yielding 1,224,911 lb. copper, or about 9 lb. per ton. The profit from operations was $428. Although the profit was negligible, and was more than discounted by various company expenditures, the record for 1912, when the price of copper was between 16 and 17 cents, indicates that ore yielding only 9 lb. of copper per ton could be mined profitably to-day. During 1913 the company produced 137,163 tons ore yielding 1,428,693 lb. copper, or about 12 lb. per ton. This was sold at 15.4 cents per lb. It cost 15.75 cents.

During the past few years increased efficiency has been obtained, and with high prices ruling, the Victoria should make money. At present, however, it is a one-shaft mine, and is incapable of making a very large production.

The Lake Mining Company is developing the Lake lode. This deposit differs in structure from most of those being worked in the district. The beds in the main range west of the Lake mine, dip uniformly to the northwest and strike northeast. The Lake lode where discovered strikes north and dips west. Development proved that the lode bends towards the west. Near the western boundary of the property the lode strikes west and dips south. Explorations on the adjoining property, south Lake, also show the lode dipping south.

Owing to the unusual structure, development of the Lake lode has taken longer than expected. Work was begun in 1906 and some very promising bodies of ore were disclosed in exploratory drifts. The lode is wide and in places rich; but there are considerable portions containing little copper. The hanging wall rock is not easily recognized, and has not been a very useful guide in drifting. There are practically no outcrops which would help in unravelling the structure. The determination of the character of the deposit has consequently consumed much time and money.

In 1912 the mine had been equipped for regular production, and it was expected that good results would be obtained. Unfortunately adverse conditions were encountered, and then in 1913 the strike made it impossible to operate. Recently operations have been resumed and the company now has an opportunity to determine the possibilities of the lode under favorable conditions.

The White Pine Copper Company is operating a property in the Porcupine Mountain district, west of Ontonagon village. The mine is isolated and the transportation difficulties have hampered development and will tend to increase cost of production. The orebodies are much faulted, and determination of their extent has been difficult. Much of the copper in the ore is in very small particles not easily recovered. In spite of these difficulties, however, the mine has been brought to the producing stage and is expected to be very profitable, the ore being richer than that of most Michigan copper mines.

The White Pine orebodies are beds of sandstone carrying native copper and chalcocite. Such deposits were known to occur in this district many years ago and a serious effort to work them was made at the Nonesuch mine, three miles west of the White Pine. The Nonesuch mine was, in 1907 and 1908, tested by the Calumet & Hecla Mining Company. A stamp-mill was installed and fairly good results obtained, but the amount of ore found was small. Later the Calumet & Hecla Company obtained a controlling interest in the White Pine property, where ore similar to that at the Nonesuch had been found. By diamond drilling a promising deposit was located and exploration by shafts and drifts was then begun. Two beds, known as the "first lode" and "second lode" have been opened and found to be well mineralized. The beds are gray sandstone like that at the Nonesuch mine. The first, or upper lode, is the better. The beds average about 6 ft. in thickness, varying from 4 to 6 ft. They lie parallel and close together, being separated by about 5 ft. of dark colored slate. The hanging wall bed of the upper lode is a thick bed of similar black slate. The footwall of the lower lode is red sandstone, which, at a depth of about 40 ft. below the lode, contains numerous pebbles. This conglomerate phase is fairly persistent and forms a good horizon marker.

It has been found that the lodes are much faulted. In many cases these faults, of the normal type, have allowed blocks to drop in such a way as to increase the apparent dip. In one place faulting of this character has brought the upper lode almost exactly into line with the lower lode.

The property has been developed by three shafts. Two of these are inclined shafts which will be for permanent use. The third is a temporary shaft.

The company reports concerning operations during 1914 as follows: "The openings on the first level west of No. 2 shaft have been rather poor. The second level east of No. 1 shaft has been badly faulted, but shows good values when in the lode. The second and third levels west of No. 3 shaft have opened fair ground, and these two levels between Nos. 3 and 1 shafts are very good. The fourth level drifts, east of No. 3 and east of No. 4 shafts are good as far as opened. Eight thousand tons of ore was hoisted, making about 28,000 tons all from openings, now in stock piles."

Mill buildings were erected during 1914, and machinery has been installed and the plant is now in operation. The concentrates are hauled to Lake Superior and carried thence by water to the Calumet & Hecla smelting plant at Hubbel.

ANTIMONY.

The rise in antimony has been as spectacular as in any of the "war metals." A year ago it was selling for 6 87½ cents a lb., and to-day special brands are bringing around 45 cents. French brands are selling at 40 to 42 cents, and Chinese at 36½ to 37½ cents. The big commercial use of antimony is in making of type metal, which is roughly 2 or 3 per cent. tin, 10 per cent. antimony and the rest lead. Because of higher prices of those three metals there has been an advance of two or three cents a pound in certain kinds of type metal.

NEW YORK CITY'S MINING MEN

By P. B. McDonald.

Most mining men go to New York City at one time or another. Many go back disappointed. A few find things so much easier than they expected that they never cease to talk about how they showed "that New York bunch" several new points. Almost all of them discover that New York is entirely different from what they had thought: it is more honest or more crooked; perfectly sound and businesslike or all bluff; exceedingly well informed or "innocent as a baby;" according to the personal experiences of each one.

Jim Butler, of Tonopah, Nevada, said he "guessed they'd got a permanent camp there alright." Men fresh from the wilds of Alaska, Porcupine, and "the bush" in general, concede that the tram-car service is pretty good. They usually admit that having once learned three or four principal corner-posts, it is not difficult to pace one's way around without a compass, in which respect the American metropolis excells that tangle of labyrinths where copper is sold and Tom Lawson used to operate.

It is not generally recognized that New York is a metallurgical centre of considerable importance, and that within an hour's ride of Wall Street there are some of the largest and most elaborate refining and smelting plants in the world. Of New York's importance in metallurgical lines, both in plants and metallurgists, no one can have any doubt who looks into the facts. As to mining and mining men, there needs to be a word or two said.

In the world of finance New York's position is of course unquestioned, and it stands for "big business" in an unprecedented way. But in mine financing it is weak, and has nowhere near the ability, the nerve, and the understanding of mining as a business which London has. New York has not the discernment, the initiative, or the variety of mining knowledge which one would expect from its position in finance. The vast majority of its bankers positively refuse to have to do with mines, and particularly with prospects. The popular impression of mining ventures in down-town New York is that all of them are crooked, and the successes only accidents. Mining is not taken so seriously as in London. It is to be regretted that mining as a business is not more understood in America's greatest financial centre.

On the other hand there are some points to be said in its favor. New York is rich and powerful and offhanded, and sometimes does surprising things in a mining way; for there are strange paradoxes in the attitude and affairs of the New York financiers. There is a lot of gambling spirit there, and romance is sometimes lurking where least expected. A big, sure mining proposition properly handled has no trouble in raising funds. The chances of a small or moderate-sized venture [illegible] depend upon a [illegible] of conditions, the general state of the money market, politics, the weather, a good deal on personalities, and more or less on merit.

Just as there are in the mining camps, men who follow around the new discoveries and become prospecting, staking, trying and driving, some honest and some not, so there are in New York keen, shrewd fellows who keep posted on new developments in the different phases of the mining business, promoters, traders, agents, brokers, etc. It is sometimes difficult to distinguish whether they are too crooked to do business with or not. Some have substantial interests in other lines, and only dabble in mining because it's in the blood; some have surprisingly good connections, though these are not usually so intimate as they say; some are poor and fairly honest, others rich and very shifty. All of them are sharp and opportunists to the nth degree. Occasionally, just as in the camps, one of them makes a killing and from the rank of hanger-on or bluffer springs into fame as a full-fledged president of a mining company or as a successful speculator.

This mining fraternity around New York is a varied, cosmopolitan bunch. They quarrel among themselves, yet will always combine against a greenhorn. They lie to each other, but know that they expect to be lied to. They pass the word around about new developments and new comers.

There are some exceptionally able men among them, keen, hard traders who know more in a minute about driving a bargain than their average opponent knows in a week. Good and bad, honesty, bluff, lies, ability, acquaintance, knowledge, and all, are so inextricably mixed up in New York's mining circles, that one has to be able to accept things as they are, and to play the game as the others do to get results. There is one point to keep in mind in dealing with these men, which is, that while they may not know some of the things that you do about the practical end of the business, you are safe in giving them credit for knowing a very great deal about their end of it.

It is sometimes astonishing with what ease one gains an introduction and admittance to a master of finance in New York's inner circles. And it is equally astonishing to find the type of man some of them are; not nervous, busy individuals with only seconds to spare, which is the usual picture of a captain of industry, but deliberate, clear-thinking men who refuse to be hurried or worried, and whose business day is made up of a few talks carefully gone into. They are exceedingly shrewd judges of men and business opportunities in general, but withal not quite sure of themselves with a mining proposition.

There is, in New York business offices, a vast deal of ability almost incomprehensible to a miner, a perfection of methods that he finds difficult to realize; but there is also a lack of knowledge of mining and of the spirit of the camps which makes for misunderstandings at critical times. It is this apparent non-comprehension of the things that to [illegible] about which so discourages some mining men who come to New York.

We must [illegible] that this American Gomorrah is only to be expected when conditions are considered. And, despite its shortcomings, New York is the business capital of its country, the greatest, most daring, and most cosmopolitan of American cities. Some particularly deserving cases of mine financing which could secure no support in Montreal, Toronto or Boston, have come to New York, raised the money easily and made success in operation. But worthy ventures that have gone a-begging in New York have met with instant response in London. The point of view of the two great money centres is quite different. The city on the Thames is consistently on the watch for precious metal, tin, or gem mines, no matter where located, Burma, Bolivia, Siberia, Colorado, Spain or West Africa. The American Babylon wants big, low-grade [illegible] of the Utah [illegible] transitions when it will consider other varieties if properly presented. Personality counts for something in New York, individuality is important in London.

THE THEORY OF TUBE MILLING

By H. A. White.

(Continued from last issue.)

The effect of varying loads of pebbles.—The subjoined table III. gives the maximum H.P. observed with the different pebble loads tried, and the number of revolutions per minute at which that H.P. was required. To make this speed comparable for the different diameters of tube employed, the "angle of departure" of the outer layer of pebbles is also given, as this would be approximately the same, under similar conditions, whatever the diameter of the tube mill might be. The sine of this angle is also given, as this function depends directly upon the number of revolutions per minute.

It is convenient to express the height of the pebble load in the tube mill by the distance in inches of its surface when at rest above (+) or below (—) the axis of the tube mill.

It will be observed from the figures given that the most suitable speed (and this is conveniently ascertained from the pebble lifting H.P. quoted), depends to a certain small degree upon the load used when the diameter remains the same. If the load is increased the speed must also be slightly increased to get the best effect; this is accompanied by the spreading out of the layers across the tube, thus giving more room for the fall of a large quantity of pebbles, though a sacrifice in height of fall of the outer layers also occurs. It will be noted that the load 0 in., that is when the tube is half full, gives the maximum power consumption in each case. This is the effect of the compromise between forming more layers of pebbles and maintaining a high average fall of all pebbles present.

In practice, therefore, if the full load (0 in.) cannot be used (because of power available or other reasons), it would in some cases be advisable to reduce the speed, especially for coarse battery crushing where the gain in average fall per cycle of each pebble might be more advantageous than a greater number of pebbles with a correspondingly smaller fall. The problem resembles the adjustment in batteries by reducing the number of drops per minute and increasing the fall in accordance with the product to be crushed.

Upon comparing the angle of departure for the varying diameters of tube used, it will be seen that the smaller tubes require to be driven at a greater speed than that which would correspond with the speed required in the larger tubes; except in the case of the bar liner. This effect is most probably due to slip, which prevents the lighter loads in the smaller tubes being carried up to the theoretical angle corresponding with the speed. The much rougher working surface shown by the ribbed liner counteracts this slip in much the same way as the heavier loads in the larger tubes. In practice the percentage of moisture present may exercise similar effects besides affecting the amount of adhering sand carried up by the pebbles, but in any case it seems probable that a smoother liner would require a greater speed of revolution than is the case with the iron bar ribbed liner, all other things being equal. Subject to slight modifications in accordance with size of pebbles employed and coarseness of primary crushing, it may be deduced that the most advantageous way to run the standard tube (5½ ft. by 22 ft. shell) would be (using silex liners) 31 revolutions per minute with a pebble load up to the centre. If bar ribbed liners are used, the speed would be about 30 revolutions. It is obvious that if thick silex liners are employed, the tube should be driven two or three revolutions faster when a new liner is put in, and this would to some extent avoid the very poor crushing shown in this case, due to the three-fold disadvantages—smaller effectual tube, greater slip, and unsuitable speed.

The visual observations made lent no support to the view that any significant portion of the working effect is due to grinding between the pebbles, though the slight increase of —90 product obtained when the tube is overloaded is probably made in this manner at a great waste of power. It is obvious that the greater portion of the work is done by impact of the falling pebbles, either directly on the liner, or on pebbles lying on the liner. This being the case, it will obviously be an improvement if the trunnion outlet or discharge screen is made of sufficient diameter to keep down the level of water or fluid pulp to the point that practice may prove most efficient, and the observations also indicate that such level would depend to some extent upon the loading of pebbles employed, in the sense that the smaller loads would require the lower effective discharge levels.

Table III.—R. P. M. Corresponding With Maximum H. P. for Various Loads.

Diameter	Load.	Net H.P.	R.P.M.	Angle.	Sine.	Liner
in.	in.			deg. ft		
75	+ 16	5·87	25·4	43 32	·68878	Unlined
"	+ 8	8·14	25·6	44 24	·69966	"
"	0	10·87	25·5	43 58	·69419	"
"	—3·5	10·63	25·2	42 47	·67795	"
"	14	8·85	24·5	39 50	·64078	"
66	+ 12	5·23	28·5	49 44	·76304	Concrete
"	+5·5	6·51	28·0	47 26	·73649	"
"	0	7·30	27·3	44 26	·70008	"
"	— 2	6·73	27·0	43 13	·68476	"
65	+ 17	4·42	28·2	47 22	·73570	Concrete
64	+ 6	6·01	28·8	49 4	·75547	Concrete
"	+2·5	6·81	27·6	43 37	·69382	Steel bar ribbed
"	0	7·25	27·0	41 37	·66414	"
"	— 5	6·08	26·4	39 25	·63495	"
62	0	6·39	28·0	43 47	·69193	Concrete
60	— 7	5·04	29·0	45 55	·71833	"
59	+ 12	3·97	31·2	55 1	·81915	"
58	+ 10	4·44	31·7	56 3	·82953	"
57	+ 4	4·79	30·7	49 53	·76455	"
56	+ 2	4·98	31·6	52 45	·79600	"
55	+ 7	4·94	33·0	55 14	·82148	"
"	5	4·80	32·7	50 24	·77051	"

The diameter given is the inside measurement of tube, less diameter of pebbles employed.

The angle refers to angular distance from horizontal diameter at which the outer layer of pebbles leaves the tube lining, and the sine of this angle is given in next column.

In order to further elucidate the facts observed, the subjoined table IV. was prepared, based entirely upon

the theory of the tube mill. This theory is of course based upon the fact that in a moving tube the pebbles begin to fall when the radial component of their weight is equal to the centrifugal force. The observations made show no serious discrepancy with the calculations, except in so far as the wider deductions have to be controlled by the facts observed, and allowance made for the factors which cause complications beyond those it is possible to deal with mathematically.

This table (IV.) illustrates the observed fact that between the loads of 1 in. below the centre and 4 in. above it, there is no very great change in power consumed and probably very little in tons of —90 produced per H.P., provided that the speed is varied accordingly. The given speed, 29.52, corresponds with a maximum of fall in the outer layer which strikes the lining direct, and would therefore represent the speed at which the wear of the liner becomes greatest.

The point of maximum capacity thus calculated is not identical with the point of greatest efficiency, but it is probably the most important for practical use.

Table IV.—Theoretical Maxima of Pebble Lifting H.P. for Standard Tube Mill with Various Loads.

Tube mill diameter inside lining, 59 in.
Pebbles assumed to be 2 in. equivalent diameter.
Load of pebbles when tube full, 21.92 tons.

Taking the speeds given, the total loads possible at that speed which will allow free fall to all the pebbles is calculated; next the free fall per cycle for the average pebbles is obtained; this multiplied by the average number of cycles per revolution gives the average fall per revolution; from this the H.P. is readily ascertained.

R.P.M.	Pebble Load	Average Fall per Cycle	Average Fall per Revolution	Pebble Lifting H.P.
	in.	ft.	ft.	
26·38	15	3·96	6·16	11·59
28·18	— 8	3·75	5·46	69·97
28·24	— 7	3·73	5·36	72·51
29·52	— 4	3·57	4·94	81·64
29·74	— 3	3·48	4·78	81·76
30·43	— 1	3·42	4·58	82·29
31·07	0	3·39	4·53	90·09
32·20	**+ 3**	**3·03**	**3·82**	**91·43**
32·67	+ 4	2·90	3·54	89·22
33·12	+ 5	2·52	3·05	83·50
34·50	+ 7	2·32	2·74	80·88
35·11	+ 8	2·07	2·30	75·03

In actual tube mill operation additional H.P. would be required to overcome friction outside the tube, inside pebble friction, and any power consumed in lifting up portion of the pulp feed (dependent principally upon moisture and feed tonnage). Any overloading with pebbles beyond the figures given for each speed will at first result in increase of H.P. (principally wasted in inner space where no free fall can be obtained), and subsequently the power will fall off owing to reduced fall allowed by the excess pebbles.

Discussion on Pebble Working Level. In practice the pebbles in a running tube are so arranged that the point of impact is everywhere below the axis of the tube. Observations with the experimental tube show that the level below which all the pebbles have completed their fall, depends upon the load of pebbles and upon the relation between the number of revolutions per minute and the square of the tube diameter.

The level so defined is referred to as the working level; and it is clear that if water or fluid pulp remains in the tube above this level, a certain portion of the effect of the falling pebble will be lost and power thereby wasted. The formation of this level is the only effect that could be dealt with experimentally, but the application of the results will be modified in practice, partly in accordance with the percentage of moisture present and partly owing to the useful effect of the fluid in removing from the tube the particles sufficiently ground. Part compensation is caused by the reduction in effective weight of lifted pebbles owing to their submergence.

Observation shows that this level is not clearly defined, owing to the fact that the pebbles do not fall dead but rebound, either from the lining direct or from other pebbles lying thereon, and that the theoretical curve joining points of impact is materially modified by this effect and by the tendency of the fallen pebbles to heap up to the limit of the angle of repose. In every case the effect of loading pebbles beyond the tube centre is to raise the working level, and this explains the customary 3 in. above the axis, which is the loading used with a high level pulp discharge, the gain being due to saved splash energy, as so large a load cannot be maintained in free-falling flight at the usual speeds.

The important figure to be measured is the effective diameter of the discharge screen which will keep the fluid down to this working level, but it is to be noted that in practice the diameter most suitable may be less than either the theoretical figures or those deduced from actual measurements when pebbles only [illegible].

Table V. shows theoretical diameters (1) for outside layers of pebbles, (2) for lowest falling pebbles. (This diameter is not directly dependent upon diameter of tube but only upon number of revolutions per minute, and is associated with that inner layer whose "angle of departure" is 37 deg. (45 ft.). Table VI. gives actual measurements of observed working levels, but all the figures in these tables are expressed in terms of [illegible] to figure the fluid outflow to the working level observed.

Table V.—Theoretical Discharge Diameters.

Standard tube mill [illegible] in. inside lining. Flint pebbles.

R.P.M.	[illegible]	[illegible] (any tube)	[illegible]
	in.		in.
23·0	21	21	42
		20	40
		19	38
28·2	18	18	36
		17	34
		16	32
31·0	15	15	30
32·0	14	14	28
32·6	13	13	26

All the above figures assume pebble loading [illegible] to speeds quoted; any overloading will reduce the diameter of discharge screen required, but the exact relationship is too complicated to calculate.

It is also assumed that area of screen openings is sufficient to prevent backing up of the pulp inside the tube.

Table VI.—Observed Discharge Diameters.

Diam. of Tube (inside lining).	R. P. M.	Pebble Load.	Diameter of Discharge.
in.		in.	in.
62	23.2	— 7	42
"	24.6	— 7	42
"	27.4	— 7	44
"	31.0	— 7	40
"	35.0	— 7	36
66	23.5	— 3	56
"	25.5	— 3	50
"	28.5	— 3	44
66	25.5	0	39
"	28.8	0	36
63	22.2	0	36
"	26.5	0	33
66	25.6	+ 3	43
"	28.5	+ 3	36
60	24.2	+10	14
"	26.0	+10	15
"	27.2	+10	15
"	28.7	+10	17
"	31.2	+10	20
"	32.7	+10	21
61	24.6	+12	14
"	26.5	+12	15
"	29.2	+12	17
"	32.2	+12	22
68	30.0	+14	26
"	30.2	+19	20

The foregoing figures clearly demonstrate that the effect of higher speed of revolution is to decrease the diameter of discharge outlet required, unless loads are very excessive, but that the contrary effect is obtained by increasing the loading of the tube. In any practical experiments upon variations of screen discharge, by means of scoops or in any other manner, these facts must be carefully borne in mind or the results may only lead to confusion.

Size of Tube Mill Pebbles.—The experiments made included all sizes of tube mill pebbles between 1 in. and 4 in. As theory and observation alike indicate that the vertical height of fall in a standard tube mill under normal conditions will vary for different layers between the limits of 40 in. and 14 in., it was decided to determine what size of particles could be broken with pebbles of various dimensions at ascertained heights of fall. Table VII. gives particulars of the results obtained from which the following conclusions may be drawn:—

The weight of the pebble and height of fall are mutually dependent factors, so that a given piece of banket may be broken by either increasing the weight of the pebble or the height of the fall thereof. It follows that tube mills of greater diameter are likely to be suitable with very coarse battery crushing, and that the only limit to successful tube milling of even products taken direct from the rock-breakers is the mechanical one of size of tube mills and the provision of large enough pieces of banket to operate in them. By calculation (from the observed figures) it may be concluded that in an 8 ft. diameter tube mill, 2 in. cubes of banket would easily be broken up by using 8 in. pebbles.

It may be deduced from the figures that ½ in. pebbles may be retained within the tube if no coarser screen is used in the battery than 9 mesh, but that when ½ in. or 1 in. screening is used in the battery the tube mill discharge should be arranged to elimin-

Tabe VII.—Height of Fall of Pebbles to Break Particles of Banket.

Weight of Pebble Used	Diameter of Equivalent Sphere (Assuming sp. gr. 2.7).
28·2 grammes	1·0676 inches
220 "	2·118 "
645 "	3·032 "
1157 "	3·682 "

Size of Particle to be Broken	Height of Fall			
	1·0676 in. pebble	2·118 in. pebble	3·032 in. pebble	3·682 ib. pebble
— ½ in. + ⅜ in.	42 in. drop does *not* break particle	19·5 in.	7·0 in.	4·0 in.
— ⅜ in. + ¼ in.	Do.	9·0 in.	3·2 in.	1·8 in.
— ¼ in. + 5 mesh (I.M.M.) *i.e.*, — 0·25 in. + 0·1 in.	11·5 in.	1·5 in.	0·5 in.	0·3 in.
— 5 mesh + 8 mesh *i.e.*, — 0·1 in. + 0·0625 in.	1·5 in.	0·2 in.	Very small drop breaks particle	
— 8 mesh + 10 mesh *i.e.*, — 0·0625 in. + 0·05 in.	0·4 in.	Very small drop breaks particle		
— 10 mesh + 16 mesh *i.e.*, — 0·05 in. + 0·03125 in.	0·2 in.	Very small drop or continued rolling breaks particle	Rolling breaks particle	Particle cannot support weight of pebble

ate all pebbles under 1 in., and might preferably be slotted so that flat pebbles with that diameter would be rejected.

It would seem that 2 in. or 2½ in. pebbles are large enough if the battery screening is no coarser than 9 mesh and that 3 in. to 3½ in. pebbles are required if very coarse crushing up to 1 in. screens in the battery is employed. No obvious advantage is apparent in using larger pebbles than those quoted, except to allow for wear by abrasion.

The height of fall is the distance measured between bottom of falling pebble and top of particle to be broken. Chert is the most difficult constituent of the banket to break, mixed quartzite next, and pure quartz the least difficult.

The — ½in. + ⅜ in. material was practically all quartzite; the — ⅜ in. + ¼ in. had less quartzite, and the —0.25 in. + 0.1 in. was a mixture of quartzite and quartz in nearly equal amounts. In this case the drop given is that required to break the quartzite. In the remaining cases quartz predominates, and the drop given is that required to break the quartz. In view of the variation in material, no attempt is made to deduce any law of crushing from these figures. The flint pebbles used were subsequently dropped 70 ft. (a) upon a concrete floor and (b)upon a steel plate 1¼ in. thick. The pebbles rebounded vigorously from the concrete floor, but none were broken. Upon the steel plate all tried were broken by the fall into two, three or more large pieces.

Coarseness of Feed.—With the standard 5 ft. 6 in. x 22 ft. tube at the Princess Mill, battery screens with 1 in. aperture have been successfully employed, though the pebble chips discharged increased very considerably. This difficulty was not insuperable. With battery screens of ½ in. apertures much less difficulty is met with in this direction; as using ⅝ in. holes in tube discharge screen it is possible to do without the pebble eliminator entirely and to run the entire discharge over the plates where the rounded nature of the escaping pebble chips prevents much interference with amalgamation as the high extraction (75 per cent.) sufficiently demonstrates. Other mines have used or are using ½ in. screens in the battery, but with larger diameter tubes; with the standard tube it must be admitted that the ease of working is very considerably increased if the battery screens are reduced to ¾ in. aperture. The tube discharge then contains much less very coarse material, and the duty is not very noticeably increased (about 3 per cent.). It thus appears that material coarser than ¾ in. cubes may to some extent escape fracture and is only gradually worn down to the point where it is certain to be broken and thus released from circuit. Of course with such feed to the tubes the necessity of keeping up the size of rock for pebble hammers of greater importance.

Amount of Feed.—Numerous experiments have demonstrated that the standard tube requires more than 400 tons of sand per diem to produce the greatest possible quantity of [illegible] product. The maximum has not been determined, and special arrangements will be required to enable much more than 500 tons per diem to be passed through. Though the experiments apparently touch [illegible] The last feed of course depends upon the length of the tube as the pebbles have to be carried out to the outlet must have sufficient material to work on.

An improvement is shown by eliminating from the feed all material already fine enough. It is clear that the real limit to the length of the tube is reached when the effect of the already reduced material becomes excessive, and this effect is probably present when the discharged pulp shows more than a half to be of the required size. If therefore the most effective discharge level is ascertained, then the amount of feed it is possible to pass through satisfactorily determined, the correct length of the tube would probably be somewhere near the point at which one-half of the feed has been reduced to the desired size.

Moisture in Feed.—Results of experiments upon the effect of different amounts of moisture in the feed with varying levels of discharge have not yet been published. Though it appears theoretically that more water might well be used as the effective diameter of discharge screen is increased, it is probable that the determination of this point will rest upon a compromise between the various effects produced. Taking 38 per cent. to 40 per cent. of water as the most favorable with practically central discharge, a decrease in moisture must increase power required, as the pebbles will lift up an increased amount of adhering pulp. This is partly set off as the increased gravity of the pulp will reduce the effective weight of the pebble being lifted through that portion of its path which is below the pulp level; on the other hand, increased friction would tend to increase the power consumed. With a low level discharge, increased water feed will facilitate the removal of sufficiently fine material without reducing the effect of the blow of the falling pebble by increasing the depth of mud it must splash through.

MONEL METAL.

Monel metal is a natural alloy of approximately 67 per cent. nickel, 28 per cent. copper and 5 per cent. other metals, containing no zinc, tin or antimony. The [illegible] and copper—bear the same homogeneous relation to each other in the refined metal as in the ore, the refining processes merely removing the undesirable elements. The mines from which the ore is obtained are [illegible] Ontario County, and are owned and operated by the Canadian Copper Company, a subsidiary of the International Nickel Company, who are the sole refiners of Monel metal. The ore is reduced to the form of matte at the smelter, and is then shipped to [illegible] of the International Nickel Company at Bayonne, New Jersey, where the process of refining takes place. The refined metal is then ready to be manufactured into the form of rods, castings, forgings, [illegible]

A South Bethlehem, Pa., despatch says Germany is [illegible] Bethlehem Steel Co. is filling its [illegible] to Krupps Gun Barrels and has [illegible] munitions of war. Although the Bethlehem plant is [illegible] Lehigh Valley R.R. at Sayre, Pa., the Lehigh Valley Railroad Co. is [illegible] Bethlehem Steel Co. is [illegible] Lehigh Valley Railroad Co. is [illegible] Germany has a 70 per cent. interest. All coke and gas which Bethlehem Steel Co. needs to run its blast and open-hearth furnaces and much machinery is procured from the Lehigh Coke Co. Lehigh Valley Railroad Co. furthermore, will soon be making benzol, as it is now putting up a $350,000 plant for the purpose. It is said that Bethlehem Co. threatened to lease the Ontario coke up a plant on its property if the Lehigh Valley Co. would not sell coke and gas.

A despatch from Fairbanks, Alaska, says Guggenheim Brothers have completed $17,000,000 worth of gold and silver bullion of Santa Gertrudis Mining Co., an English company, and are transporting it to Vera Cruz. Penrose has been lodged with British Consulate.

FLOTATION TESTS ON COBALT SILVER ORES*

By Herbert J. French.

For the purpose of this investigation, five variable factors were considered, no one of which is entirely independent of the others:

1. Oil — a. Variety of oil; b. Amount of oil
2. Amount of acid (only sulphuric acid used)
3. Agitation — a. Length of agitation; b. Speed of agitation
4. Temperature of solution.
5. Size to which ore is crushed.

The effect of variations of each one of these factors upon the extraction of metallic mineral was investigated in turn, and having experimentally found the best condition for the first factor, this was kept constant, and the second variable then considered. In performing the experiments, however, it was necessary to deviate slightly from this system, but the results obtained from the experiments as performed gave equally satisfactory results.

The machine employed in the following tests was improved to its present form by the Minerals Separation staff, and was given to the School of Mines by James M. Hyde. The driving mechanism was a 1/16 h.p. motor connected to a 110 volt line through a variable resistance. The machine, and its operation are fully described in Hoover's "Concentration of Ores by Flotation," Chap v.

The method of making a test is as follows: Fill the machine with water to a level slightly above the middle. (If it is desired to heat the solution, repeatedly pour boiling water into the machine until the walls have become hot and then fill with water which is near the desired temperature). Add the ore and agitate for a few seconds until thoroughly wetted. When the ore and water have reached the desired temperature, heat being obtained from Bunsen burners, add the acid in the proper proportion. Next add the required amount of oil and turn on the motor, bringing it gradually, but quickly, to full speed by means of the variable resistance. After the required agitation, stop the agitator and allow the emulsion to settle for about one minute to allow time for the froth to collect on the surface of the water and for the gangue to settle. The upper part of the machine is then slid along the plane of contact, carrying with it the froth and that portion of the clean water above the plane of junction of the two parts, and discharging them into a pan. This process may be repeated on the tailing, without or with the addition of more oil; but before further agitation, water should be added to just above the sliding plate. The tailing and remaining water are then withdrawn into a pan, through the bottom spigot, allowed to settle, and the greater part of the water decanted. The tailing is then dried, screened, mixed, sampled and finally assayed or analyzed.

Treatment of Coniagas Silver Ore.

The ore upon which the following tests were made was obtained from the Coniagas Mining Company, Cobalt, Ont., and represents the material fed to the stamps. The ore contains about 13 oz. Ag per ton, mainly in the form of pyrargyrite (Ag_3SbS_3), proustite (Ag_3AsS_3), argentite (Ag_2S), dyscrasite (Ag_3Sb), and native silver. The procedure was the same as for the Bisbee ore, but in this case the tailings were analyzed for silver.

The ore was first assayed, using three different charges, with results as follows:

	Charge No. 1	Charge No. 2	Charge No. 3
Ore	1 A. T.	1 A. T.	1 A. T.
PbO	2¼ A. T.	2 A. T.	2¼ A. T.
Na_2CO_3	1 A. T.	1¼ A. T.	1 A. T.
Bx. Gl.	1/6 A. T.	1/6 A. T.	1/3 A. T.
Bx. cover	1/3 A. T.	1/3 A. T.	Salt. cov.
Ag. found, oz. per ton	13.61	13.62	13.10

The chief difference between charges 1 and 2 is that the latter has somewhat higher Na_2CO_3, and is lower in PbO. Charge 3 is equivalent to 1 except that a salt is used. Charge No. 1 was selected for the assay of tails, as with this charge frothing was prevented and the slag was cleaner. Charge No. 2 gave equally good results, but the slag did not look so clean as that of No. 1.

1. Variation of Oil.—Preliminary tests were made to determine which oil is best suited for effecting flotation of the values in this ore. Results are given below:

Effect of Various Oils on Cobalt Ore.

Ore, 100 gm. Water, 1,500 c.c. Agitation, 1 min. Room temperature. Oil, 8 drops. Acid, 1 gm.

Oil.	Wt. of Tails, gm.	Wt. of Froth, gm.	Oz. Ag. per Ton Tails.
Pine-tar	97	3.0	9.6
Fish	98.5	3.0	12.46
Sperm	98	2.0	12.94
Corn	84.0	16.0	13.36
Whale	98.0	2.0	13.8
Cylinder	(a)	...	....
Rapeseed	90.0	10.0	10.87
Lard	90.0	10.0	13.13
Cottonseed	93.0	7.0	12.16

(a) No froth.

The results show clearly that pine-tar oil is far superior to the other oils tried. Rapeseed oil gave a comparatively good extraction, but it was noted that the froth was not so lasting as that produced by the pine-tar oil.

The amount of oil used in these tests was very small, the purpose being merely to indicate the most promising of the oils available, and at the same time to study their selective action. Here again it is seen that of the three or four oils giving the best results, pine-tar oil excels in selective action; whence this oil alone was used in the following tests.

The amount of oil was next varied from 1.3 gm. to 3.6 gm. per 100 gm. of ore. Results are given in Table VIII. This test shows that beyond 2.5 gm. of oil per 100 gm. of ore no benefits are derived from additional oil.

Several tests were then made to determine the effect of adding oil in successive portions. Under the same conditions as above, 2 gm. of oil (50 drops) were added in three parts, the first being 1 gm., and the second and third being ½ gm. each. The pulp was agitated each time for 2 min. and the froth was skimmed after agitation with each portion of oil. It was found that the weight of the froth obtained was far too great for good results. In other words, the froth contained nearly two-thirds the weight of the orginal ore.

*Extract from an article published in the School of Mines Quarterly.

Effect of Variation in Amount of Oil.

Ore, 100 gm. Water, 1,500 c.c. Acid, 1.5 gm. Room temperature. Agitation period, 2 min. Pine-tar oil.

Oil, gm.	Wt. of Froth, gm.	Wt. of Tails, gm.	Ag. in Tails, oz. per ton.	% Ag. remaining in Tails.	% Ag. Extracted.
0.3	7.0	93.5	11.44	84.0	16
0.6	12.0	89.0	10.20	75.0	25
1.0	15.0	84.5	8.25	60.6	39.4
1.3	11.5	90.0	8.28	60.8	39.2
1.6	15.0	87.0	8.68	63.8	36.2
2.3	16.0	87.5	6.66	49.0	51.0
3.0	25.0	78.0	...	...	...
3.3	22.0	81.0	6.45	47.5	52.5

A similar test was next tried, using half the amount of oil, namely ½ gm., ¼ gm. and ¼ gm. The weight of the froth obtained from 100 gm. of ore was 48 gm., while the metal contents of the froth was 48 per cent. of that contained in the ore, again showing that too much of the gangue was carried into the froth.

By using 100 gm. of ore and but ½ gm. of oil the extraction obtained from three 4 min. periods of agitation was 52.4 per cent. In this test, the oil was all added at first and after 4 min. of agitation the froth was skimmed. The pulp was then agitated for two more 4 min. periods, without further addition of oil, and the froth was skimmed after each period. The weight of the froth in this case was 33 gm. When 1 gm. of oil was added in two equal parts, and the pulp agitated for 2 min. after each addition, the extraction obtained was but 51.6 per cent.

It is to be borne in mind that every ore which can be successfully concentrated by flotation has its own set of best conditions. While those particular conditions mentioned below refer primarily to the ore tested, the general principles are applicable to many if not all ores.

For Coniagas ore—1. Pine-tar oil is the most efficient flotation agent among those oils tested. 2. Oil fractionation, and longer periods of agitation, gave as good an extraction with the consumption of less oil. 3. As this ore cannot be economically treated by cyanidation, it seems probable that, with proper regulation of working conditions, it can be concentrated so that the values may be recovered.

THE DEVELOPMENT OF ONTARIO OIL FIELDS.

References to the occurrence of oil, asphalt, and natural gas date back to the earliest history of Canada. Thus Sir Alexander Mackenzie noted the tar springs of the Athabasca region in the "Voyages Through North America to the Frozen Pacific Oceans," 1789, 1793. From that time until the present these tar springs have been commented upon by all the explorers of that region. Meanwhile as far back as 1830 the settlers in the neighborhood of Enniskillen in Lambton county, at the extreme western part of Ontario, noted the presence of oil in the swamps of that region. The presence of "gum oil" as the material in these swamps was called was sufficient to seriously detract from the value of the land. Oil was developed from these swamps in 1857, when Mr. Shaw dug a shallow well near Enniskillen, at a place which became known as Oil Springs. In fact, not only does the actual use of oil in Canada antedate the drilling of the Drake well in Titusville, Pennsylvania, in 1859, but in 1857, a Mr. Williams drilled a deep well in Ontario with successful results.

Drake's lucky find caused great excitement in the Oil Springs region in Ontario. This caused careful search to be made for oil indications. By 1860 hundreds of derricks had been erected at Black creek in the township of Enniskillen. The wells were all shallow, the oil being obtained at 100 ft. more or less. The first flowing well was struck in 1862 by Mr. Shaw at Oil Springs, at a depth of 160 ft., described by Mr. J. T. Henry in the "Early and Later History of Petroleum." This well was struck on Jan. 11, 1862, and before October not less than 35 wells were producing. In spite of the better known development of Western Pennsylvania, there is probably no quarter of the world where the production developed so rapidly in these early days as on Black creek, Ontario, in 1862, on account of the shallow depth at which large gushers were obtained. Several yielded as high as 3,000 barrels per day, three produced 6,000 barrels per day, and the Black and Matthewson wells flowed 7,500 barrels per day, according to Henry.

Shortly after the excitement of Oil Springs, another large oil deposit was struck at Bothwell in Kent county, about 30 miles to the southeast, and in 1865 Petrolia, 7 miles north of Oil Springs, developed a larger field, which led to the desertion of Oil Springs, in 1867, and has been a principal contributor to the Canadian oil industry ever since.

A recently published report of the Mines Branch, Ottawa, contains general information on oil and gas. An account of the occurrences in Canada is to be given in a subsequent report.

GRANBY'S OUTPUT.

On June 12 the Toronto Globe published a descriptive article by a staff correspondent, dated from Prince Rupert, B.C., in which the following occurs: "Word is heard here now that the Granby smelter, which has been shipping east to New York and Boston through Seattle, proposes to use the Grand Trunk Pacific line, which will mean from 3,000 to 5,000 tons of traffic per month for the new road." As the only product the Granby Co. ships east is blister copper, the following figures may serve to show how little reliability may be placed on the foregoing statement. Reduced to pounds the quantity would be 6,000,000 to 10,000,000 pounds a month, equal to 72,000,000 to 120,000,000 pounds a year. Now, a statement of the president of the company published in May, includes this information: "At Anyox operations have been resumed. The three furnaces are running more steadily and producing at a correspondingly higher rate. . . . Present rate of production is about 3,500,000 pounds monthly from both properties." When that statement was made operations at the company's mines at Phoenix and smeltery at Grand Forks were "now in full swing." When operating uninterruptedly to full ordinary capacity the output of copper from those works was in the 1910 fiscal year 22,750,000 lb., and in 1913 22,686,000 lb. To be well within the mark, say 1,750,000 lb. a month, would fairly represent the ordinary output capacity of the company's Boundary district mines and smeltery. This would leave, with three furnaces running, a similar quantity from the Anyox works. However, to be on the safe side and as well, to allow for increased output should a fourth furnace be completed and put in operation, say the output may reach to 2,500,000 lb. a month for the year through. This would give a total for the year of 30,000,000 lb. against the Globe writer's minimum of 72,000,000 and maximum of 120,000,000 lb. So it will be seen that writers of that newspaper have been given figures indicating a copper output more than double the probable output and a maximum at some times more than four times greater than any previous

THE DOME MINES COMPANY'S ANNUAL REPORT

At the annual meeting the following report covering the operations of the Dome Mines Company, Limited, for the fiscal year ending March 31st, 1915, was submitted by Mr. C. D. Kaeding, second vice-president and general manager.

During the year a total of 265,597 tons was mined and hoisted. Of this, 248,550 tons was ore which went to the mill and 17,047 tons was waste which went to surface dumps. All of the 248,550 tons of ore was milled, resulting in a net yield of $1,055,496.78, the average being $4.25 per ton.

Summary for Year Ending March 31st, 1915.

Total income (inc. $6,878.41 of miscellaneous earnings)		$1,062,375.19
Operating expenditures	$573,876.68	
Development	173,319.02	
Operating profit	315,179.49	1,062,375.19

hole No. 20 drilled from the surface at a 60-degrees angle flattening to 45 degrees showed 478 ft. of $3.69 ore; that portion of the hole between the 5th and 6th levels shows 4 intersections of ore totalling 119 ft. averaging $5.63. Hole No. 52 drilled from the 6th level horizontally from a point 40 ft. southwest of No. 2 shaft has shown five intersections of ore totalling 127 ft. averaging $4.42. Hole No. 53 drilled on the 6th level horizontally, parallel to and 75 ft. east of hole No. 52 showed two intersections of ore totalling 233 ft. averaging $7.28. However encouraging are these drilling results below the 5th level, both as to values and their indications of tonnage, pending further development they are not included in the estimate of ore reserves, the position of which as at April 1st, 1915, is:

Tons.	Value.	Total.
2,782,811	$4.15	$11,576,858.71

The net result of actual development has been to place in reserve over twice the tonnage of ore milled during the year containing nearly three times the amount of gold extracted.

Operating Costs and Tonnage Milled by Months, Dome Mines Co., Ltd.

1914-15	Tons Ore	Mining Inc. Hoisting	Cost Per Ton	Development	Cost Per Ton	Crushing and Conveying	Cost Per Ton	Reduction	Cost Per Ton	General	Cost Per Ton	Total	Cost Per Ton
April	14,710	$12,939.95	$.880	$13,096.27	$.890	$2,402.21	$.163	$18,340.54	$1.247	$ 8,046.39	$ .547	$54,825.36	$3.727
May	16,180	14,522.52	.898	11,818.03	.730	2,053.16	.127	18,894.99	1.168	8,546.95	.528	55,840.65	3.451
June	18,160	13,160.54	.725	13,229.98	.729	2,420.66	.133	17,760.96	.978	9,254.10	.510	54,826.24	3.014
July	19,780	12,090.90	.611	17,213.82	.870	2,055.34	.104	17,164.89	.868	8,233.88	.416	56,758.83	2.870
August	22,110	10,915.48	.494	16,740.93	.757	1,160.69	.052	16,960.39	.767	9,580.02	.434	55,363.51	2.504
Sept	21,940	12,770.50	.582	17,943.55	.818	2,477.01	.113	20,284.82	.925	11,118.91	.507	64,594.79	2.944
Oct.	22,500	10,417.11	.464	18,592.07	.826	3,155.64	.140	21,513.33	.956	11,032.24	.490	64,710.39	2.876
Nov	22,040	17,318.39	.785	13,044.20	.592	4,176.70	.190	23,132.48	1.050	8,793.98	.399	66,465.75	3.016
Dec.	23,090	16,597.33	.719	9,207.99	.399	3,370.92	.146	24,766.50	1.072	10,554.22	.444	64,396.96	2.789
Jan.	23,220	16,431.65	.708	11,896.35	.512	2,938.00	.127	23,592.69	1.016	8,507.91	.366	65,366.60	2.729
Feb.	21,600	13,604.54	.630	14,085.36	.652	2,657.02	.124	22,056.49	1.021	8,195.54	.379	60,616.95	2.806
Mar	23,220	18,840.06	.809	16,450.47	.709	2,520.34	.108	23,934.30	1.030	14,967.55	.640	76,712.72	3.300
Total	248,550	169,608.97	.682	173,319.02	.697	31,405.69	.126	248,407.38	.990	114,816.89*	.461	737,557.95*	2.967

*Total carries a credit of $1,720.80 for Misc. Income.

Operating Costs.—The total operating cost per ton milled for the year, including all development and diamond drilling, but excluding depreciation, was $2.967, which compares with $4.197 for the preceding year, the decrease being $1.230 per ton. This reduction is due to the larger units of operation, improved methods, and to greater efficiency in all branches of the work. Details of operating costs by months will be found in an appended table.

Development.—The development work has been distributed on the various levels and within a zone 1,500 ft. long by 400 ft. wide. Besides definitely determining the two million tons "indicated" by incomplete development a year ago in the vicinity of No. 2 Shaft there has been developed, in addition, a large body of better grade ore on the 4th and 5th levels of a character similar to that originally milled from the so-called "Dome." This latter ore has its apex it would seem, at the 3rd level, or 260 ft. vertical from the surface. At the 4th level, 330 ft. vertical it is 330 ft. long and 120 ft. wide. On the 5th level 424 ft. vertical it is 160 ft. long and 60 ft. wide. Below the 5th level and extending to the 6th level a vertical distance of 130 ft. the latest results obtained by diamond drilling have been satisfactory, and indicate a further tonnage. In the earlier drilling, as stated in previous annual reports,

Development Work Details.

Level.	Drifts.	Cross-Cuts.	Raises	Box-holes	Shaft	Total	Diamond Drilling	Total
1st	98	632	268	[illegible]		[illegible]		[illegible]
3rd	[illegible]	811	330			1,841	900	2,741
4th	297	389	[illegible]			894		894
5th	581	372	311	[illegible]		[illegible]	[illegible]	3,058.5
6th	295	207	[illegible]			611	[illegible]	1,803
Shaft	..	..	..	..	83	83		83
Surface	..	..	..	..	..	..	2,160.6	2,160.6
Total	1,971	2,411	1,226	532	83	6,223	[illegible]	[illegible]

Enlarging and straightening drives, station construction, sumps, 85,000 cubic feet.

The expenditures incurred in the above work $173,319.02, averaging $.697 per ton of ore milled, has been a direct charge upon current operations.

Plant and Equipment.—The completion of the extensions to the mill, power house equipment, mine equipment, etc., begun last year necessitated an expenditure of $106,792.49 for plant.

Mill.—The addition to the milling plant was completed and put into operation in June, although the merging of the new and old units was not completed until August. It was not considered advisable to crowd the plant for tonnage at the start, but rather to bring it up to a maximum output on a sound basis

of operating efficiency, and the expected duty of 28,000 tons per month should be reached and may be exceeded during the coming year.

During the year the plant operated a total of 342 days, or 93.7 per cent. of the total possible time. The following table gives the ore value, bullion and recoveries:

		Per ton.		Pct. Extraction.
Value of ore sent to mill	248,550 tons	$4.68	$1,163,954.80	90.6
Bullion by amalgamation	$671,054.44	$2.70	57.6%	
Bullion by cyanidation	384,442.34	$1.54	33.0	
Total Bullion	$1,055,496.78	$4.24+		90.6

Minor adjustments only have been found necessary, such as increased thickener capacity, improvement of elevating system, adjustment of launders and classifiers, etc. An increase in the amalgamating plate area is in process of erection, as a greater extraction by amalgamation is expected. The operating cost of $0.99 per ton bears the burden of the improvements and alterations. This cost has been reduced from the previous year's figure of $1.440, amounting to a saving of $0.45 per ton milled.

The metallurgical results as set forth here indicate that the practice adopted is sound and economically of a high order. Additional knowledge gained by further experience with the ore will indicate refinements of present practice.

Microphotograph of Dome Mine Gold Ore

General.—The physical condition of the property is better than it has been for some time past. Proportionately larger amounts have been spent upon repairs and improvements resulting in larger and better air and steam mains, improved heating, better houses and offices, roads, etc. The small 16 cubic feet ore cars used for tramming and hauling ore on the main level and up the incline shaft to the crusher house have been replaced by 93 cubic feet cars. This work entailed the enlarging and straightening of drifts, relaying several thousand feet of track with improved equipment, constructing a head frame, bins and grizzlies. The cost of these improvements has been a charge against current operating, the cost of crushing and conveying during the year has, however, been reduced from $0.252 per ton to $0.126.

To further facilitate the handling of the ore a system is being installed consisting of five ton cars for use underground, a large underground crusher, automatic loading hoppers, four ton skips, and a surface haulage with five ton cars to the crusher house from No. 2 shaft. The skips have already been installed and are operating, and the loading station and ore pocket below the 5th level completed. The crusher station and ore passes are fifty per cent. complete. It is hoped to have this system operating by the summer.

A system of shrinkage stopes has been laid out underground on the 3rd and 5th levels and breast stopes cut, with boxholes and chutes completed, so that a large stoping area will soon be available for underground mining. An increasingly greater tonnage will be taken from these stopes from month to month and it is anticipated that the cost of mining can be held level as the stoping efficiency is improved. Average operating costs for the year suffered from two high months at the start and one at the end of the year, the latter due to a shortage of hydro-electric power. From August on, the cost of all supplies and equipment advanced materially, due to war conditions in general and to increased tariffs affecting all manufactured articles, as well as raw materials. The adoption of the Workmen's Compensation Act on January 1st has been an added tax, but one which we welcome, as placing upon a sound and equable basis the distribution of compensation for injuries sustained at the work.

A further reduction in the operating costs during the next fiscal year may be expected.

Balance Sheet, Domes Mines Co., March 31st, 1915.

Assets.

Cost of properties		$2,575,000.00
Buildings and equipment as at March 31st, 1914	$1,178,878.45	
Expended for additional construction and equipment during the year less salvage recoveries.	106,792.49	
	$1,285,670.94	
Deduct amount written off for depreciation, extraordinary repairs and improvements	116,601.04	1,169,069.90
		$3,744,069.90

Current Assets—		
Inventories	$102,921.40	
Accounts Receivable	60,760.08	
Advances	9,379.18	
Insurance Unexpired	1,641.82	
Interest Accrued	1,854.15	
Cash	307,484.06	
		484,040.69
		$4,208.110.59
Liabilities.		
Capital Stock	$5,000,000.00	
Deduct-in Treasury	1,500,000.00	
		$3,500,000.00
Current Liabilities—		
Accounts Payable	$42.211.94	
Taxes Accrued	800.00	
		43.011.94
Surplus—		
April 1st, 1914	$486,520.20	
Profit and Loss (balance as per attached account)	178,578.45	
		665,098.65
		$4.208,110.59

CANADIAN COAL AND COKE CO.

Shareholders of Canadian Coal and Coke Company, Limited, are being circularized by the directors to secure their co-operation in a plan for relieving the company of its prior lien obligations, which, it is now clear, cannot be met from the earnings of the property in the present depressed state of business in the West. The holders of these prior lien obligations, which amount to $300,000, due October 1st, 1915, and are owned by the First National Bank of Cleveland, have consented to transfer these obligations to a new company, to be formed by the shareholders and bondholders of Canadian Coal and Coke, for the sum of $18.000 cash for interest in advance to July 1st, 1916, and six successive payments of $50,000, with interest at 8 per cent., at the beginning of each half-year commencing July 1st, 1916, these payments to be secured by deposit of the $300,000 prior lien obligations themselves and of negotiable promissory notes of the subscribers to the new company's stock, maturing to correspond with the dates of payment. The new company is to secure stock subscriptions of at least $450,000 at par, and to have an authorized capital of a million, and $200,000 of this is to be allotted to the holders of the collateral trust notes—a further obligation of the Canadian Coal and Coke Company, amounting to one million dollars.

The new company has been formed and capitalized as above, under the title of North American Collieries, Limited, and the stock is now being offered to the noteholders at one hundred-dollar share for each $500 note of the collateral trust notes (of which there are roughly a million dollars), and, in case of cash purchase, at par. The necessary $450,000 in cash subscriptions required by the bank has been secured. The noteholders, who alone are entitled to participation in this subscription, are, however, offering to shareholders an opportunity to acquire notes at the original price, namely, 94 and interest, these notes conveying the obligation to convert into stock of the new company at 20 per cent., and also the right to purchase stock of the new company at par. The amount of stock which may be taken by each noteholder will depend upon the success of the subscription.

There being no other fixed charges (no bonds of Canadian Coal and Coke have ever been sold outright) the new company will be in a position to take over the property free of all interest obligations, and with a considerable amount of working capital, and with a stock liability of only one million dollars. There will be no bonus stock, commissions or water of any kind.

A more drastic liquidation of the original company's liabilities could hardly be imagined, but it seems to be thoroughly justified by the situation. Except for their right to take rank with the collateral trust noteholders on the same terms as if they had originally subscribed for notes, the common and preferred stockholders have no equity left them; and the preferred stockholders, it will be remembered, were originally bondholders. It is not, however, now a question of the propriety or otherwise of the original financing, but of securing for the original owners a right to save the property from falling into the hands of the prior lien creditors for a mere $300,000 indebtedness.—Financial Times.

THE METAL SENSATION.

Boston, June 14.—"Not in your time nor in mine is there likely again to be a situation in the metal markets such as exists at present," says an important copper producer. "Nor has such a situation ever existed in the past. The enormous consumption of metals is one of the great surprises of the war and in which the United States is a most fortunate beneficiary."

The changes both in price and the relative importance of the metals have been kaleidoscopic. The spotlight has fallen in turn on copper, spelter, lead and tin, with aluminum, quicksilver and other metals coming in for more or less attention. Sales of electrolytic copper have been made at 20¼ cents, which compares with 19 cents last week and an average of 13⅜ cents for the year 1914.

Calumet and Hecla grades of Lake copper could be sold at 25 cents through the balance of the year, but we have heard of no actual sales above 23 cents, as the company has been "out of the market" for some time.

Spelter is the big sensation. Even at to-day's price of 25 cents, which is a nominal quotation and is three or four cents under the recent top, it shows an advance of 371 per cent. over the average for the year 1914, of 5.3 cents.

Lead has been a laggard, and only within the past week or two has it joined the company with the other sensational metals. A week ago it was selling at 4.90 cents; to-day at 7 cents.

Tin has benefited relatively little by the war demand. Aluminum, by reason of its ability to compete in some measure with copper, has advanced 60 per cent. from the average of 1914, but this advance has taken place very recently.

Quicksilver, in which Boston capital has for years had a small investment interest, is up 90 per cent. over the average of last year.

Silver is the big disappointment. It is actually selling to-day 5 cents per ounce less than the average of 1914.

In the Companies Winding up Court of the Chancery Division, London, June 22nd, the petition of G. F. S. Bowles re Tough-Oakes Gold Mines (English company), was allowed to stand over for evidence.

NOTES ON HOMESTAKE METALLURGY*

By Allan J. Clark.

It is nearly three years since the metallurgy of the Homestake ore was discussed with considerable thoroughness, in a paper† read before the Institution of Mining and Metallurgy.

Certain changes have been made in this period which are perhaps of sufficient interest to justify a brief description, and it is chiefly with such details and miscellanies that this paper will deal. In the circumstances, a certain amount of repetition is inevitable, but matter treated of in the former paper will be referred to here only when it is necessary for the sake of coherency. For full dscriptions of equipment and technique, the former paper should be consulted.

The mineralized slates and schists which constitute the ore vary considerably in composition, but the unoxidized ore, perhaps constituting the major part of the reserves, contains either chlorite or hornblende (cummingtonite), with quartz, carbonates of lime, magnesia and iron, and arsenopyrite, pyrite, and pyrrhotite. Ferrous minerals predominated and this fact has been an important factor in determining the metallurgical treatment.

With one or two exceptions the minerals noted are of relatively high specific gravity, and the ore as a whole is exceptionally heavy, many determinations giving an average specific gravity of 3.00.

This high specific gravity presents one decided advantage, when the cost of treatment is compared with operations elsewhere, in that the ton, almost universally the basic unit, represents a volume probably less by 10 per cent. than that of many gold ores. On the other hand, this high gravity renders more difficult the discharge of pulp from mortars, its distribution on amalgam tables, and its transportation in launders.

In the same way, as attesting the usual balance of such variations of different ores, it may be noted that the needle-like fibres of hornblende (cummingtonite), interlacing throughout the mass, render the ore more difficult to crush than would be anticipated, but on the other hand assist in maintaining free leaching in both sand and slime treatment, retaining their characteristic form as far as they can be traced with the microscope.

The metallurgical equipment consists of:

At the South Side—3 stamp mills (660 stamps) with 36,356 sq. ft. of amalgam plates; 1 regrinding plant, with independent cone system and 540 sq. ft. of amalgam plates; 4 batteries of cones for classification; 2 clarifying-tank houses; 1 sand plant.

At the North Side—2 stamp mills (360 stamps); 2 tank houses; 2 cone houses; 1 sand plant.

At Deadwood—1 slime plant, treating the combined slime from south and north sides.

The ore supplied to the north side mills is usually drawn from the upper levels of the mine, and is at least partly oxidized. It is more easily penetrated by cyanide solutions than is the unoxidized ore, and satisfactory extractions are at present made from the sandy portion of the mill tailing without further reduction in tube mills. In almost all other respects, practice at the two divisions of the works is identical and unless otherwise stated further description will be of operations at the southern branch.

Stamp Milling.

The stamps, when newly shod, weigh 900 lb. and drop 10 in., making 88 drops per minute. Pulp discharges through No. 8 diagonal needle-slot screens. Inside amalgamation is practised, quicksilver being fed to the mortar, and a copper chuck-block, about 5½ in. wide, being placed inside the mortar, below the discharge screen. To facilitate discharge and distribution of the pulp over the amalgam plates, water is liberally used, the usual ratio being from 10 to 11 parts, by weight, to one of solids.

Electric drive, now in use for more than two years permits more nearly continuous operation than formerly. A 25 h. p. back-geared motor drives each 10 stamps, transmitting motion by a 16-in. belt.

Chuck-blocks are cleaned in rotation, the usual interval between cleanings being about two weeks; outside plates, except those of the fourth row, are cleaned and dressed daily. Fourth-row plates are dressed at intervals of two days. At the foot of the rows of plates are traps, from which the sands are removed every second or third day. These trap sands are run over a special silvered amalgam plate, the tailing rejoining the main stream of tailing. It was formerly the practice to clean these traps daily, but this is not necessary since the development of the regrinding plant, which acts, in effect, as a large trap for all the mills.

Amalgam is restored three times each month. Oil-fired retorts are used, the resulting bullion being melted in coke-fired furnaces. The loss of quicksilver in retorting is almost nil; the subsequent melting loss, which averages slightly more than 1 per cent. of the weight of the crude bullion, includes some quicksilver not driven off in the retorts.

A new mortar has recently replaced the familiar design. In this newer design the old [illegible] lines, remarkably effective in maintaining a rapid discharge, have been retained. All the front above the screen rest has been cut away, as has also a considerable portion of the back. This has given greater accessibility, with resulting safety to the men when engaged in changing iron and other necessary operations; it permits the use of longer bossheads and simplifies the care of feeders, since an observer at the front of the mortar can determine whether the ore is feeding properly. The slight tendency to splash at the back is corrected by a false back, or apron, of canvas; a small chip tray of 4-mesh screen, resting above the discharge screen, impounds floating particles of wood, which are removed from time to time, washed, and burned. The ashes, which assay as high as $300 per ton, are set to accumulate in sufficient quantity and are eventually sold.

The unoxidized ore, although carrying large quantities of sulphides, amalgamates well, but not so freely as old records show to have been the case in earlier years, when less of this class of ore came to the mills. A longer time is apparently required to properly incorporate the quicksilver with the pulp and the resulting amalgam is recovered somewhat farther from the battery.

"Skimmings" are recovered from re-treatment of the foul amalgam, sulphide particles, etc., removed from the clearup sink during the cleanup of the chuck-block and plate amalgam.

These cleanings are contained with no excess of moisture in a small barrel 24 in. in diameter by 36 in. or

*Extracts from a paper to be read at the San Francisco meeting American Institute of Mining Engineers, 1915.

†Clark and Sharwood: "The Metallurgy of the Homestake Ore," Transactions of the Institution of Mining and Metallurgy, vol. xxii., page 48 (1912-13).

long, in which iron balls or pebbles are placed, the mineral particles being ground and the amalgam recovered. The rejected sulphides, carrying perhaps $1,000 per ton in gold, are briquetted with water glass and charged to the blast furnace, when smelting cyanide precipitate or by-products.

Relation between amount of mercury and bullion recovered.—It is perhaps not customary to report inquiries which have failed of definite conclusions. The following notes of such an investigation are not without interest, despite the lack of decisive result. Records of all six mills were tabulated over a period of one year, in an effort to determine what relation, if any, existed between the amount of quicksilver fed to the batteries, the amount of bullion recovered, and the grade of the ore crushed. As was to be expected, individual determinations varied considerably from the average, but for four of the mills, and these fortunately including those crushing ore of the two extremes in value, the points coincide reasonably well with a curve represented by the equation

$$T = \frac{8.5\ B—H}{H}$$

when

T = Value of ore (dollars per ton).

H = Troy oz. of quicksilver fed to batteries.

B = Troy oz. crude bullion ($16 per oz.) recovered.

Of the two remaining mills, one was crushing surface ores with comparatively coarse particles of free gold. This, not unreasonably, showed values for H about 10 per cent. below the values indicated by the equation. The sixth mill gave results nearly 20 per cent. higher than might have been expected. This mill, on account of an insufficient supply of water, crushed nearly 10 per cent. less ore than the average and it is conceivable that the longer retention of the material in the battery caused undue flouring of the quicksilver. It is more probable, however, that the explanation is to be found in the personal equation of the millman in charge.

The crushing units are not in conformity with modern ideas, and there is no doubt that, were the plants to be built anew, radical changes in design would be made. The Homestake, unlike many younger mines, has developed gradually from comparatively small beginnings. The mills represent the growth of 30 years. Built before the cyanide process was known, they then represented advanced milling practice. It must be conceded that the stamp duty of 4½ tons, with 80 per cent. of the tailing passing a 100-mesh screen and 60 per cent. passing a 200-mesh screen, is fairly good even when compared with the results reported from many newer installations.

We find that heavier stamps crush more rock, with little or no change in the sizing of the tailing unless more open screens are used; in which case, even without increasing the falling weight, tonnage may be gained at the sacrifice of sizing. To us it appears that compactness of plant, with the saving both in first cost and, later, in labor and supervision, constitutes the leading claim of the heavy stamp for preferment. Indeed, if the gold metallurgist is ready to dispense with amalgamation—and we are by no means prepared to do this—it is more than probable that he will do well to investigate the crushing practice of modern copper mills before he commits himself to the heavy gravity stamp. Alaska, at the moment, holds more of interest than does Africa.

It may be pertinent to note that I have never encountered a Homestake mill tailing, no matter how far advanced in secondary treatment, from which some free gold could not be recovered by laboratory amalgamation tests.

Sundry operating and cost data of stamp milling are appended:

Stamp Mills: Analysis of Lost Time.

Note.—The time devoted to dressing plates, about 10 battery-minutes daily, is in part included, as whenever possible the work on the battery is done during this period of plate dressing. Data of 660 stamps for 59 consecutive days.

Reason for Loss of Time.	Battery Hours.	
Installing new screens	69:20	
Installing new shoes, dies, heads	194:40	
Installing new guides, guide castings	10:35	
Installing new mortars	63:55	
Installing new tappets, cams	20:00	
Installing new cam shafts	6:25	
Installing other equipment	37:00	401:55
Setting tappets	685:10	
Pull-outs of stems	122:20	
Broken stems	343:05	
Broken shoes and dies	15:10	
Loose cams	39:50	
Miscellaneous repairs	120:05	1,325:40
Motor trouble	253:20	
Drive troubles	5:20	258:40
Total lost time		1,986:15
Total battery hours		186,912
Percentage of total time lost		1.07

Cost of Stamp Milling.

	Stamping	Amalgamating: Normal Charges.	Amalgamating: Relining Plate House
Operating labor	$0.0895	$0.0164	
Other labor	0.0033		$.0064
Power	0.0457		
Machinery	0.0028		
Water	0.0315		
Sundry supplies	0.0097	0.036 quicksilver; 0.0042 silver plating; 0.0016 miscellaneous	0.0059 silver plating; 0.0018 lumber
Total	$0.2425	$0.0245	$0.0141

Power at $30 per h. p. year; quicksilver at 50c. per lb.; castings, 2½c. per lb.; mill labor, $2.97 per 8-hr. shift.

Regrinding.

Operations at the regrinding plant offer little of interest, the practice conforming closely to the usual methods.

The feed to the tube mills is already so fine (only 25 per cent. remains on a 50-mesh screen) that the efficiency of the mills is low. The critical size of sand delivered to the sand plants is about 100 mesh for unoxidized ore, and 80 mesh for oxidized ore. It is advantageous to operate the mills in closed circuit, but it is difficult to do this without permitting sulphide particles which have been sufficiently reduced in size, to remain in the circuit. By introducing a double baffle or trough classifier, containing a hydraulic device, into the slime-overflow end of a Dorr classifier this difficulty has been in a measure overcome, and two of the mills are at present using this system.

Sand Treatment.

The sand is leached with cyanide solution in vats 44 ft. in diameter by 9 ft. deep, holding 610 tons of sand each. The operations are distinguished by unusual care in the preparation of the material for extraction, rather than in the extraction itself.

Classification and aeration are the two essentials to successful work. The latter, necessary to overcome the tendency of the ferrous compounds in the ore to

remove the vital oxygen from the solutions, is achieved by forcing, at intervals, air under slight pressure into the false bottom, below the filter canvas. The sand charge is suitably drained before this air is applied; the pressure is so adjusted that the air is forced into the charge, yet is so low that the column of sand is nowhere broken or disturbed. To secure this immunity thorough classification is essential, and this has always been recognized as a matter of first importance.

Four batteries of cones, each fed from the discharge of the preceding set, the first three sets acting by gravity alone, the last assisted by a hydraulic connection, deliver a very clean sand to the vats. As a further precaution, the vat is filled with water before sand is turned into it, so that a constant overflow is maintained during filling and a final separation of slime particles added to the sum of the cone separations. As a matter of fact, the sand is so clean when it enters the vat that this final step is not one of strict necessity, but we have found that a charge filled in this manner is in a less compacted condition, presumably easier to leach and certainly easier to discharge.

The action of the air is interesting. Laboratory tests indicate that, on an average, about 75 cu. ft. of oxygen is absorbed by a ton of ore, before its reducing action is corrected. If this air is not supplied from some extraneous source, the solutions are vitiated and extraction ceases. When air is applied and is followed by a water wash, calcium thiosulphate appears in the effluent solutions; when the air is followed by cyanide, the effluents contain sulphocyanides and free cyanide appears only after some time. After a limited time of leaching, the extractive power of the solution decreases and further aeration of the charge is necessary. Each aeration is attended by the formation of some acid and the consequent destruction of some lime and cyanide. After treatment, the sand shows no sign of oxidation; neither analytical nor microscopic examination can detect differences between charge and residue.

Lime, crushed in a one-stamp mill to pass a 7-mesh screen, is added to the pulp stream as it flows to the vat. Regulation is by weighing a prescribed amount of lime into the automatic stamp feeder at 2-hr. intervals. The choice of [illegible] is determined by the fall at which the lime settles, the intent being to exhaust the particles only when treatment is completed. Formerly small quantities of lime were added to the top of charges during the cyanide percolation in addition to that fed with the sand, but this is no longer considered to be necessary and is not done except in emergencies.

It had long been considered that a high protective alkalinity was detrimental, but until within the past two years it had been tacitly accepted that it would be impossible to dispense entirely, or practically so, with protective alkali. Eventually [illegible] was done; extractions improved and consumption of cyanide was materially reduced.

The gratifying results are in a measure due to another change in procedure, initiated at about the same time. Solutions of two strengths are used, that stronger in cyanide is used earliest in the treatment of a charge. When these solutions appear as effluent, one portion is precipitated, the other brought to full working strength by adding cyanide and then returned to the extraction of another charge of sand.

This custom is by no means universal, yet whatever is used the procedure seems to be to maintain the stronger solution at a high content of gold and to allow the weaker to vary in strength according as the varying losses in treatment may determine. This is wrong in principle. The critical strength is that below which the weaker solution will no longer dissolve its quota of gold, or, if dissolving it, will no longer freely yield it to precipitation. If the strength is greater than this, we may confidently expect some cyanide to be destroyed without giving compensatory service. In such circumstances, if the maximum working strength is reduced, the weaker solution will be automatically restored to the lowest economic strength; if it falls below this, a temporary increase in the maximum strength will restore it. In other words, cyanide should be added to the strong solution in accord with the determinations of strength made on the weak solutions. Thus, operating with a strong solution of variable strength and a weak solution also variable, but never far from its effective limit, it may be anticipated that little cyanide will be needlessly expended.

(To be continued.)

FIRST AID AMONG COAL MINERS IN B. C.

The continued interest among coal miners in British Columbia in the movement to extend the instruction in "First Aid to the Injured" is demonstrated by the fact that in May and the early part of June 102 men passed examinations held under the auspices of the St. John Ambulance Association, after various classes for instruction had been conducted by duly qualified surgeon instructors. Results were as follows: Passed on Vancouver island, at Nanaimo, 22 for certificate, 1 for voucher and 4 for medallion; total 27. At Extension, 8 for certificate and 1 for voucher; total 9. At Cumberland, 3 for certificate. Passed on the mainland, at Fernie, Crowsnest Pass, 59 for certificate, 2 for voucher; 1 for medallion and 1 for label; total 63.

On May 24, a First Aid competition was held at Michel, Crowsnest Pass. Five teams entered, each of five men, including a "patient." Two prizes were offered, each being a set of five gold medals. The team captained by R. Spruston gained 97 points, that by R. Stacey 93, by Ed. Heyes 82, by J. Touhey 70 and by A. Frew 48. The discounts from a possible maximum of 100 were taken from a schedule arranged by a combined committee of the First Aid classes at Coal Creek, Fernie and Michel. The judges of the competition were District Mine Inspector G. O'Brien, of Fernie; Mr. J. Quinn, of Michel, and Mr. J. Johnson, of Coleman, Alberta. The prizes were presented to the respective winners by Mr. Thos. Russell, superintendent of the Crow's Nest Pass Coal Co.'s Michel colliery.

At a meeting of the representatives of First Aid [illegible] in the employ of the Crow's Nest Pass Coal Co. at Coal Creek, Fernie, and Michel, respectively held recently at Fernie, [illegible] were made in connection with a First Aid competition to be held at Fernie on July 1. Details were examined and [illegible] arranged. It is expected that interest in the sport will be general among the miners and that competition will [illegible]. The company's general manager, Mr. W. R. Wilson, of Fernie, is doing all he can to induce the miners generally to take instruction in First Aid, and in this he is being actively supported by the company's superintendents and [illegible] officials. The district mine inspector, [illegible] directing all they can, while Mr. Dudley Michell, [illegible] instructor in First Aid for the Provincial Department of Mines is most assiduous in furthering this beneficent work.

BURNSIDE GOLD MINES.

In the Assize Court at the Toronto City Hall, before Mr. Justice Sutherland, Charles E. Henrotin, a mining engineer, is suing C. A. Foster, Henry Cecil and the Burnside Gold Mining Company, of Kirkland Lake, Ontario, for $150,000, being seven and one-half per cent. of the stock of the company. Henrotin said that this arrangement was made when he guaranteed to turn over options on the property to the company. As an alternative, the plaintiff says he will take 30,000 shares of the company's stock. In a counterclaim the mining company is suing Henrotin for $50,000 damages. The Burnside Company was floated in England last year, with a capital of $2,00,000.

C. E. Laurie, the first witness to-day, a mining engineer of thirty years' experience, had made an examination of the Burnside Mines. A valuable vein was shown on the property adjoining. The witness believed that it dipped into the Burnside property. Having regard to the capitalization of the company, he thought that the Burnside claims were valuable. Mr. Henrotin was the best man to arrange for the purchase of the Burnside property, because he was a member of the same college fraternity as Mr. Burnside.

He told of an agreement whereby Mr. C. A. O'Connell, manager of the Tough-Oakes mine, adjoining the Burnside, was to become interested with Henrotin and himself in the latter mine. While it was not openly spoken of it was tacitly understood that by letting O'Connell in on the deal the "Anderson interests" would also become identified with the Burnside property.

"What did Mr. O'Connell do that you should make this agreement?" asked Mr. W. N. Tilley. "Up to this time he had only thrown us over the Tough-Oakes property."

"Do you still think this arrangement a good one?" "Yes."

At the subsequent formation of the Burnside Gold Mining Company $1,000,000 was to be set aside as promoters' stock. It was understood that $500,000 of the capital stock was to be held as treasury stock. Mr. Laurie, who said he had had experience in forming these companies thought it was most important to have a substantial block of treasury stock on hand. The plaintiff was to receive 7½ per cent. of the stock, and of this amount 22½ per cent. was to be turned over to Mr. O'Connell.

While in England, the witness offered Mr. Foster his interest in the options on the property for $25,000.

"When I left England he expressed a desire to secure my interest, but there was no culmination." said Mr. Laurie.

The chairman of the board of directors, Mr. Simpson, who was examined, in London, England, estimated the company lost up to $250,000 by the action of Henrotin in filing a caution against the mine. This was responsible for them not being able to carry on their work fully.

C. A. Foster, one of the defendants, was the last witness examined before adjournment. He said he had been engaged in mining operations for thirteen years. In 1912 and 1913 he was interested in the Tough-Oakes mines.

"Mr. Henrotin came to see me at the mine and said he wanted to make some money," said Foster. "He said he had some gentlemen from Toronto who were interested in mining development. He mentioned the name of Mr. Massey. I asked him how much money they could put up and he said $10,000. I told him I would look around and see what I could get."

"A week later Mr. Henrotin returned to the mine with Cecil and Laurie," continued the witness. "Cecil wanted to know if he could see any showing from the Tough-Oakes. He said if it impressed him favorably, he would like an opportunity of buying something for people in England. I told him that none of the properties I was interested in were for sale. I told him it would be good business for him to secure the Burnside property. He said he would send Henrotin and Laurie to Haileybury to get options. Cecil said he would pay a reasonable commission to them after the work was finished.

"Henrotin said he could get the options, except a one-quarter interest. I told him there would be no difficulty as the owners of that quarter were personal friends of mine. I made an arrangement with the owners, Anderson and Duncan, of Haileybury, to give Cecil the interest for $50,000. As an alternative he could secure one-eighth for $25,000 with the remaining eighth in my name. Mr. Cecil accepted this offer."—Toronto Star.

BUTTE MINERS QUIT FEDERATION.

Alleging that in the twenty years of its affiliation with the Western Federation of Miners it had contributed $1,000,000 to the federation, for which it had not received one cent's worth of benefit, and hinting at irregularities in the handling of strike funds by federation officers, the Butte Miners' Union, the parent organization of the Western Federation of Miners has formally withdrawn from the federation, repudiated the contract which existed between the two organizations and ordered its charter returned to federation headquarters at Denver.

The action is the outcome of friction between the Butte Miners' Union and the Western Federation, which culminated a year ago in the dynamiting here of federation headquarters.

MICHIGAN COLLEGE OF MINES.

The Michigan College of Mines board of control reorganized last month, following the recent re-appointment of William Kelly, of Vulcan, and James MacNaughton, of Calumet, as members.

Following the meeting Dr. McNair gave out the following changes in the faculty, which were approved by the board:

Prof. E. D. Grant, promoted from assistant professor of physics and mathematics to be associate professor in the same department.

C. E. Rood named assistant professor of physics and mathematics.

Resignation of Prof. John D. Black, in charge of the department of technical writing.

Arthur D. DeFoe, now instructor in engineering English at the University of Michigan, to take charge of the technical writing and language department, including the new course in Spanish.

At the annual meeting of the Calumet & Hecla Mining Co., Geo. A. Flagg, secretary and treasurer, was elected a director to succeed Quincy A. Shaw.

Vice-president R. L. Agassiz stated that since January 1st the company has purchased and placed in its sinking fund $920,000 of the 4 per cent. ten-year notes.

PERSONAL AND GENERAL

Mr. Samuel W. Cohen has returned to Cobalt from a three months' trip to Nicaragua where he was engaged in the examination of gold mines under option to the Crown Reserve Mining Company, Limited. Assisting Mr. Cohen in the examination were Mr. E. L. Steindler, Mr. A. Burnett, Mr. H. Bischoff and Mr. G. Miller.

Mr. Chas. E. Henrotin is suing Messrs. C. A. Foster and Henry Cecil and the Burnside Gold Mines, Ltd., for $150,000 for his option on the Burnside property at Kirkland Lake, Ont.

Mr. Stewart Thorne, of Cobalt, is recovering from an operation for appendicitis.

Mr. H. G. S. Anderson was in Denver, Colorado, lately, on his way to Nevada. Since leaving Cobalt, Mr. Anderson has been in Mexico.

Mr. H. Foster Bain, now editor of "The Mining Magazine," London, has been elected a member of the Institution of Mining and Metallurgy.

Mr. W. M. Brewer, of Victoria, B.C., has left that city on another trip of investigation into conditions in mining districts of British Columbia, under instructions from the Department of Mines of that province.

Mr. Henry Clark, Canadian representative of Head, Wrightson & Company, has returned to Victoria, B.C., from a trip to Australia and New Zealand. On his way back he paid a short visit to California.

Mr. F. Satchell Clarke, of Vancouver, B.C., was in San Francisco, California, in the early part of last month.

Mr. James Cronin, of Spokane, Washington, is again in the Babine section of Omineca mining division, British Columbia, where he is continuing development work on mineral claims he has held for several years.

Dr. Chas. W. Drysdale, of the Geological Survey of Canada, left Lillooet, B.C., with his party on June 13th for Bridge River, in which part of Lillooet district they will be occupied during the field season, obtaining data for a geological map and in examining the local ore deposits.

Mr. S. Duncan Ellis, who on leaving Toronto University went to the Braden copper mines in Chili and who last February joined the Artist Rifle Corps, in London, England, in the course of a letter written on May 22nd to his mother in Victoria, B.C., observed: "The mills of the gods are treble-screened to remove red tape."

Mr. H. W. Hardinge, of the Hardinge Conical Mill Co., New York, has been in the Northwest for several weeks. He was at Juneau, Alaska, about the beginning of June.

Mr. Robert Keffer, son of Mr. Frederic Keffer, now with the Stewart Mining Company on the Coeur d'Alene district, Idaho, in collaboration with his college professor, Mr. Francis A. Thomson, of Pullman, Washington, contributed to the June number of Metallurgical and Chemical Engineering, New York, an article on "The Relative Efficiency of Various Amalgams in the Recovery of Gold."

Mr. W. H. Lanagan, mining engineer, of San Francisco, California, was in British Columbia last month.

Mr. A. W. McCune, Sen., of Salt Lake City, Utah, was recently in Ainsworth and Slocan mining divisions of British Columbia, arranging for having done further development work on several mining properties there in which he is largely interested.

Mr. R. G. Mellin, formerly with the Tyee Copper Company has organized a syndicate to lease and develop the East Sooke copper property, on which is one of the most promising copper-ore deposits yet found in the southern part of Vancouver Island, B.C.

Mr. Dudley Michell, of the British Columbia Department of Mines, whose especial work it is to arrange for holding among miners classes for instruction in First Aid to the Injured and to assist in familiarizing them with the use of the pulmotor, is in the Crowsnest district of the province, whence he will proceed to Rossland in July to attend the twentieth general meeting of the Western Branch of the Canadian Mining Institute, the programme for which will include a demonstration of First Aid Work by Rossland miners.

Mr. Louis Pratt, well known in Slocan district of British Columbia, where for years he was in charge of a silver-lead mine, and later connected with various mining enterprises of Mr. Patrick Burns and associates, has for some time been in France, where he has been successful in securing for the firm of P. Burns & Co., of Calgary, Alberta, orders for comparatively large quantities of supplies for army uses.

Mr. Robert W. Service, best known as the poet of the Yukon, author of "Songs of a Sourdough" and other collections of poems, is stated to have left London about the end of May as a chauffeur in the Anglo-American Ambulance Corps, an organization under the auspices of the Red Cross, among the members of which are many Harvard men, some of them well-to-do men who are driving their own motor cars in their endeavors to assist in the humane work the corps is engaged in.

Mr. Bradley Stoughton, secretary of the American Institute of Mining Engineers, has returned to New York City from a visit to some of the mining centres of the Western States.

Mr. Francis A. Thomson, head of the department of mining engineering at the State College of Washington, Pullman, Washington, with a small party of his senior students, has been visiting mines and smelting works at Rossland and Trail in West Kootenay, and in the Boundary district, also in British Columbia.

Mr. John Vallance, for a number of years superintendent of the Standard silver-lead mine, near Silverton, Slocan Lake, B.C., recently paid a visit to his home at New Denver, in the same district. Since leaving the Slocan two or three years ago he has been in succession the foreman at Tooele, Montana, where with one of his sons he is successfully established.

Mr. R. A. Bryce was in Toronto last week. After a visit to Cobalt he will go to British Columbia to examine properties there.

M. Beatty & Sons, Ltd., Welland, have been successful in getting an order from the War Purchasing Commission for five carloads of material handling machinery, made up of hoisting engines, derrick irons, turntables, centrifugal pumps and clamshell buckets. This will be used by the Overseas Construction Corps in Europe. The order was received on Saturday, May 29th, and goods were forward, knocked down and packed for ocean shipment, on Tuesday, June 1st.

On and after June 15th, the Boston office of the Sullivan Machinery Company will be situated at No. 183 Devonshire Street, Room 1010 Unity Building, instead of at 75 Federal Street.

Mr. J. C. Murray was in Toronto last week.

Mr. Roscoe Wheeler, superintendent of the Hedley Gold Mining Company's 40-stamp mill and cyanide plant at Hedley, Similkameen, was in Victoria, B.C., during two days of last month.

Mr. W. R. Wilson, general manager for the Crow's Nest Pass Coal Company, was in St. Paul, Minnesota, when trouble arose in connection with the refusal of British and other miners to continue working with alien-enemy miners, and had to make a hasty return to Fernie, B.C., to direct the company's affairs until this unlooked-for difficulty was successfully overcome.

The Keuffel & Esser Company have issued a circular descriptive of a Surveyor's Duplex Slide Rule, recently placed on the market.

Mr. George L. Carter, president of the Carter Coal Company, Coalwood, W. Va., awarded a contract on May 1st to the Roberts and Schaefer Company, engineers and contractors, Chicago, for the complete designing and building of a large steel "Marcus" patent coal tipple, complete with screening and picking facilities and three "Rand" shaking loading booms, for installation at the large shaft mine recently sunk on the property of this company at Coalwood, W. Va. Price, $60,000. This is one of the most important contracts that has been awarded for some time in the West Virginia field.

Manufacturers estimated that the 400 locomotives recently ordered by Russia will require 3,200,000 lbs. copper and 40,000 tons steel. The unusual quantity of copper is said to be due to specifications requiring that metal for fire boxes.

Among mines in British Columbia that lately resumed shipment of ore, though only on a small scale, are the Monarch, in Northeast Kootenay; Silver Hoard, in Ainsworth camp; Sally, near Beaverdell, on the Kettle Valley railway west from Midway; and Iron Mask, near Kamloops, in Yale district.

A news dispatch from Butte, Montana, gives the following information: "The Stewart Mining Company is now earning $70,000 to $80,000 a month, and is pushing development work on its new property on Vancouver Island, British Columbia, which is being opened by a water-level tunnel." The earnings mentioned are from the operation of the company's mine in the Coeur d'Alene district, Idaho; commercial production has not been commenced at the Vancouver Island property referred to.

Patrick Clark, of Spokane, a well known Western mining man, died rather suddenly last month at the age of 65.

He learned his trade as a coal miner in Scotland, emigrated to the States, worked in the Hoosac tunnel, on the Comstock lode, sank the first shaft on the Anaconda and discovered it was a copper and not a silver mine.

He built the first plant for milling the galena ores of the Coeur d'Alene and discovered and at one time owned the famous War Eagle mine at Rossland.

Two large chests of gold bullion from Dawson and Fairbanks and 50 tons of gold concentrates from the Alaska-Gastineau mine at Thane, reached Seattle, Wash., on June 8th by the steamship Mariposa, from Alaskan ports. This gold was the first received at Seattle from the Alaska mines this season.

B. C. COPPER.

On Monday, June 14, a commencement was made to prepare the British Columbia Copper Co.'s smeltery at Greenwood, Boundary district, B.C., for resuming smelting. One of the 800-ton blast furnaces is to be operated for a while, and the intention is to blow in the two other furnaces when a sufficiently large supply of ore shall be available. The work of dewatering the company's Mother Lode mine near Greenwood had previously been commenced. It has been announced by the Greenwood "Ledge" that for the time 50 men will be employed at the smeltery, a similar number at the Mother Lode mine, and 30 at the company's Lone Star mine, situated about ten miles from Greenwood, immediately south of the International Boundary line. Mr. F. S. Norcross, Jr., is general superintendent of the company's several mines; Mr. P. E. Crane is superintendent at the Mother Lode; Mr. F. J. Longworth is to resume the post he some time ago held, as assistant superintendent of the smeltery. Mr. Oscar Lachmund remains general manager, with headquarters at Greenwood.

A press dispatch from Fairbanks, Alaska, dated May 24th, stated that gold bullion valued at approximately $250,000 had been shipped over the trail to Chitina and outside during the previous two weeks by the Wells Fargo Express Company, and was then on its way to San Francisco. This was the earliest shipment of gold made from the interior for years.

THE SEA IS HIS

R. E. Vernede, in "London Evening Star."

The Sea is His: He made it,
Black gulf and sunlit shoal
From barriered bight to where the long
Leagues of Atlantic roll;
Small strait and ceaseless ocean
He bade each one to be.
The Sea is His: He made it—
And England keeps it free.

By pain and stress and striving
Beyond the nation's ken,
By vigils stern when others slept,
By many lives of men;
Through nights of storm, through dawnings
Blacker than midnights be—
This Sea that God created,
England has kept it free.

Count me the splendid captains
Who sailed with courage high
To chart the perilous ways unknown—
Tell me where these men lie!
Tell me a path for ships to come
They moored at Dead Man's Quay;
The Sea is God's: He made it—
And these men kept it free.

O little land of England,
O mother of hearts too brave,
Men say this trust shall pass from thee
Who guardest Nelson's grave.
Ay, but these braggarts yet shall learn
Who'd hold the world in fee,
The Sea is God's—and England,
England shall keep it free

SPECIAL CORRESPONDENCE

NEW YORK

"War" continues the big topic of conversation in financial circles. Regarding what the United States could do in a world war, the general opinion is much as E. S. Martin expressed it in an editorial in "Life," namely, that "anyone knows who knows anything," that in a world war the United States, with her immense resources, her one hundred million population, and the traditional adventuresomeness of her young men, would be a factor of tremendous importance.

The extraordinary prices now existing in the metal market are coming in for much comment. Particularly copper, zinc, and lead have soared so high that the price of copper is 50 per cent. over the average of 1914; zinc has advanced nearly 400 per cent. in a few months, while lead, although lagging, has nearly doubled in a week or two. Mining companies, which had given up all hope of ever making any profits, are reaping rich gains daily; yet mining men are taking the situation very conservatively, and few count on it to last.

The "World's Work," a comprehensive monthly, directed editorially by Ambassador Page, of London has estimated that so enormous is the consumption of ammunition on the battlefields of Europe that the American factories are contributing less than one per cent.

Greene-Cananea, the big Sonora copper mine and smelter in which many Lake Superior people are interested, is to resume after a shut-down of months occasioned by warring conditions in Mexico. The State Department arranged for its re-opening with Carranza.

Ingersoll-Rand Co., well known to mining men, is turning out 1,000 shells a day at its Phillipsburg, New Jersey, plant.

Much praise has been expressed, both in the United States and France for Charles M. Schwab, who owns Bethlehem Steel Co. that is so busy making gun munitions for the Allies. He refused an offer of $100,000,000 from German interests for the sale of his company, and offered to turn over the entire plant to France, merely because he likes France and detests Germany.

Considerable interest has been expressed at this time in the Chinese Commission now visiting the United States, and it is noted that several of the Commissioners are mining men in China. As lately remarked in the "Mining and Scientific Press," in spite of Japan's machinations the Chinese possess a racial entity as strong and resistant as the Hebrews which will tend to offset the island empire's interference in the big Oriental country.

It is computed that Bethlehem Steel Co. can put iron ore from its new mines in Chile, at the furnaces in South Bethlehem, Penn., for slightly less than what it pays for lake ores there, since the company has to buy the latter and pay mining companies a profit, in addition to rail transportation of $1.45 from lower lake ports to Eastern Pennsylvania. It is not expected that the Bethlehem Co. can get Chilean ores to its furnaces any cheaper than lake ores are put down at Pittsburg, in Western Pennsylvania, by steel companies operating their own mines. Bethlehem Steel also secures ore from Northern New York State, Sweden and Cuba. Ocean freight of $2.00 per ton and Panama Canal tolls of $1.00 per ton on Chilean ores will eat up money.

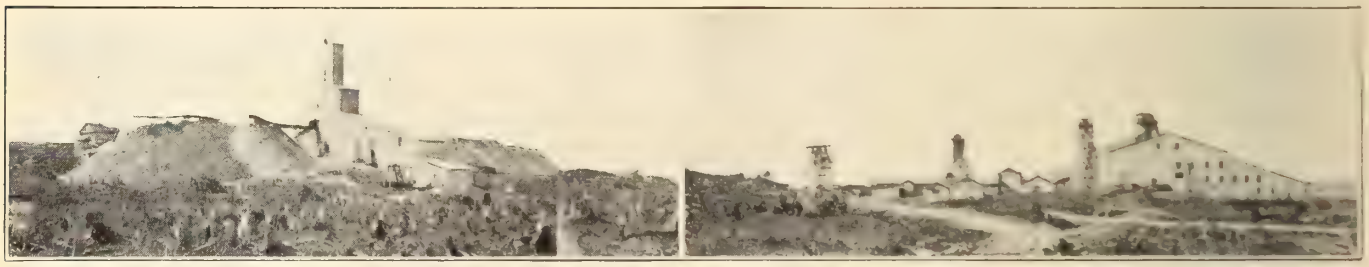
Cobalt Lake, Opposite T. & N. O. Depot. Showing Pump House and Pipe Line Used in Dewatering.

PORCUPINE AND KIRKLAND LAKE

Hollinger.—There is considerable drop in the grade of Hollinger ore for the four weeks ending May 30. For the period the ore only ran 0.56 oz. against a previous minimum of about $11.00. Mr. Knight explains this position as due to the necessity of curtailing production in order to rush development, as development has been very much hindered by the power shortage in April, and as a result much of the ore treated came from development during the last period. The report shows that of the total of 34,750 tons of one hundred 3,674 tons was from development and 18,092 tons from stopes. The greatest activity was on the 200 and 300 ft. levels. All the ore below the main [illegible] level came from development with the exception of but 6 tons. The mill ran 95.5 per cent. of the possible running time, treating 31,112 tons, of

which 23,821 tons was Hollinger ore and 10,971 tons from Acme Gold Mines. Only 30 stamps are being used to crush Acme ore, the other 70 being reserved for the Hollinger. Total costs were a few cents above $3.50, of which milling costs amounted to $1.047 per ton and mining costs $1.786 per ton. The gross profits for the period amounted to $139,187. This was produced by a cost of $84,662.00, of which $42,537 was for mining and $24,936 for milling. The surplus stands at $1,264,093. The financial statement shows that the expenditure for plant additions for this year amounts to $187,112. It is stated on good authority that there is no immediate intention of building a separate mill for the Acme; that some provision will have to be made for much larger tonnage of Acme ore is certain, but the development of this property has not yet reached the stage where it is necessary to make a decision at once.

McIntyre.—The first visit of the new directorate of the McIntyre has been made to the mine, and as the result of the impression they received it is understood that a most aggressive policy of development is planned. It has been determined to sink a shaft at No. 5 works to the 700-ft. level without delay. It is expected that the tonnage treated at the mill in the month of June will be at least as high as any previous month since more ore is now being taken from the sections of



Acme and Hollinger Gold Mines, Timmins, Ont.

the property where sericite is not present in large quantities.

Wright.—Quite a little excitement has been caused in the camp by rich ore found in the shaft on the Wright property in Deloro township. This shaft has only been put down 40 ft., but a crosscut is now being run to determine the width of the orebody, as it is certainly a good deal wider than the shaft itself. These claims are under option to the Pike Lake Gold Mining Company, by whom the work has been done under the supervision of Mr. J. B. Phillips.

Schumacher.—The frame work and structure of the Schumacher mill has been finished; the contractors making record time. Work on the foundation did not start until the 17th of April. All the machinery has been ordered, but nothing has been delivered as yet. Cross-cutting at the 300-ft. level towards the McIntyre boundary, a vein four and a half feet in width has been struck at a distance of 265 feet from the shaft. This vein was the first of the series got with the diamond drill some 30 feet below the 300-foot level. Stopes are rapidly being put into shape on the 100-ft. level.

Moneta.—The annual report of the Moneta Porcupine Gold Mines has been issued. It shows that there is in the treasury but a few thousand dollars and that there is no present intention of starting up the property. Of the 2,000,000 shares capitalization there is still in the treasury about 450,000 shares; but Sir Henry Pellatt, the president, says that the market is now in such condition that it would be unwise to endeavor to sell treasury stock to finance further development. The small revenue which the company is obtaining from the sale of town lots and the rents is all that is now accruing to the company. Expenses are confined to the salary of a caretaker. The Moneta claim consists of a sandy claim adjoining the Miller Middleton. The sinking of a shaft had to be attempted through sand and by the time rock was struck a stream of water was tapped and work was abandoned.

Dome Lake.—Operations on the Dome Lake are confined entirely to production, no development being attempted. On the lowest scale of expenditure a good profit was made on the $7,000 in gold bullion produced during the first half of the present month.

Dome.—The last monthly report of the Dome shows the largest tonnage ever crushed at the property for May; also there has not been a larger bulk of bullion produced in any one month with the exception of January, 1913, when the grade of ore ran $8.00 in comparison with $4.28 during the month of May. While this grade of ore is still low it is better than for many months past.

The Kirkland Lake Gold Mine Company will probably start up its plant at the beginning of next month. This company owns a block of claims adjoining the Teck-Hughes mine. In the shaft recently a few shots were put in a vein showing in the wall of the shaft, which is about 60 ft. down; the high grade ore in this vein is seven inches wide and will run $200 to the ton. The shaft is now 80 ft. deep. It will be carried to the 150-ft. level without delay. It is expected from the dip of the known veins that cross-cutting can be conducted from this level to the most advantage.

COBALT, GOWGANDA, SOUTH LORRAIN

Alien Enemies.—A very vigorous campaign has been started to intern alien enemies in the district of Timiskaming. This movement originated in the Cobalt camp and the petition has already been signed by hundreds of people. It is stated that an attempt has been made by alien enemies to blow up the Nipissing magazine and that dynamite has been stolen from various magazines for no peaceful purpose. The mining companies of the camp do not favor the idea of taking away from them many of their best muckers, but they would not actually oppose any such move. As a matter of fact many Austrians and Germans have been allowed to go within the past two months, and it has been almost impossible for them to obtain work again. There are a large number of them idle in the camp. It is felt that as these men are in very poor financial condition, the situation is not good, and all the mining companies would favor the interning of all these alien enemies who are out of work; they would also favor the registration of all alien enemies and the in-

ternment of those who have shown themselves outspoken in their espousal of the German cause.

Temiskaming.—The situation of the Temiskaming is still one of uncertainty. To date, June 17, no contract has been signed with the power company. This is taken to indicate that the directorate had not yet given up the idea of putting in an independent plant. In the meantime the power company is allowing operations to continue at the old scale. There is little doubt that if a power plant were put in, it would be made to serve the needs of both the Temiskaming and Beaver, and it is surmised that this would be the first step towards the amalgamation of these properties. This week the Temiskaming shipped two cars of ore. Both these cars came from the mill; one of them was of low grade concentrates, the other a 30-ton car of table concentrates running about 2,000 oz. to the ton. While operations underground are confined largely to development, good results are being obtained. A new vein or the extension of an old vein has been opened on the 400-ft. level in the old workings; and its width and grade indicate that it may be of some importance.

The Coniagas Mining Co. is building a trestle across Silver street in the town of Cobalt. The waste pile from the new shaft on Prospect avenue has already caused the abandonment of three or four houses on Silver street. The new trestle is being built so that the waste rock will be dumped on the other side of the street, a section where there are few houses.

Crown Reserve.—Mr. S. W. Cohen and some members of his party have arrived back from Nicaragua. Two members of the party are still at the Bonanza mine, where they will still continue to sample.

It is learned that the Crown Reserve Co. has not definitely decided to take up the option on the Nicaragua property. The directors believe that transportation is so difficult and the building of roads to Waterhead will entail so much money that the option price must be lowered before the proposition will be a profitable one for the company. The property has several veins approximately 30 ft. wide running about $6.00. Only the top of these veins has been taken off by primitive methods. The mill is of simple construction and it would be necessary to install stamps before a requisite tonnage can be obtained. While there is any quantity of labor the quality is lacking. Transportation is a great difficulty. The mine lies 300 miles from the coast. Most of the journey is made by water; but there is a distance of half a day's journey on mule back.

Silver Leaf.—Good results are still being obtained from the Silver Leaf at the 125-ft. level. The vein is, if anything, stronger. Fifteen to twenty tons of high grade ore have already been accumulated, and a good tonnage of milling ore is also ready for concentration.

Peterson Lake.—Upon the Peterson Lake mine a new vein has been struck in the Keewatin formation on the old Little Nipissing. While the vein is of smaltite, and the assays are encouraging, the management does not attach very much importance to this discovery since it is entirely in the Keewatin and some distance from the contact.

Silver Queen.—It is learned that the Silver Queen has been leased to a syndicate of Cobalt men, and that more search for ore on this old property will be attempted. The practice of leasing is growing in the camp. The Princess is now under lease to a Haileybury Syndicate. The Right-of-Way is being worked by the company itself, but under an agreement something approaching that of a lease.

Cobalt Lake, Showing Drained Portion Near Nipissing Mill.

In Gowganda the Miller Lake-O'Brien Mining Company has started to resume work on a small basis. Since the power broke down last winter the mill has only been running for 12 hours out of the 24; now there is plenty of water to run the turbines [illegible] sumption to full power will soon be possible.

BRITISH COLUMBIA

An unlooked-for occurrence was the stopping of work on June 8th by coal miners in the Crowsnest [illegible] of Southeast Kootenay, consequent upon their having determined to secure the removal from the coal mines of the district of workers of the nationalities of the countries with which Great Britain and its allies are at war. Meetings were held, and deputations were made both by officials of the United Mine Workers of America and of the Crow's Nest Pass Coal Company, but the miners remained firm in their demand. Eventually they returned to work on condition that unmarried aliens be not [illegible] excluded from the

mines and that those who have families be required to register and report to the authorities with a view to further action later on so far as these latter are concerned. In this connection it may be mentioned that, as reported in the newspapers, Superintendent Bernard Caulfield urged upon the objecting miners that the responsibility of taking the action demanded should not be placed upon the operating company, but that, rather, the Government should be appealed to with the object of having those men interned against whom this movement had been directed. He pointed out that at present the company is operating at a loss, and if the loss shall be increased by interference with the working of its mines the company may decide to close them. He submitted, further, that by keeping the aliens employed there would be much less chance of their doing harm than if they were idle. When the Crow's Nest Pass Coal Company's mines are being worked under ordinary conditions, they give employment to between 1,400 and 1,500 men at Coal Creek colliery and between 400 and 500 at Michel. Some figures published in connection with the recent trouble show the number now at Coal Creek as approximately 1,100, in the following proportions as to nationality: British, 600; Italians, Belgians and Russians, 350; Austrians, 125; and Germans, 25. It is the more important to the operators that this difficulty shall be adjusted without delay, for the chief reason that the demand for coal and coke is greater now than at any previous time since the outbreak of the European War, and with mines and smelting works getting back to working at capacity, the prospect is favorable for a continuance of improved markets for the products of the collieries.

West Kootenay.

Ainsworth and Slocan.—Generally, mining activities in these mining divisions are steadily increasing, though in most instances where work has been resumed recently operations on individual properties, apart from the Bluebell and Standard, are not important as regards the number of men for whom employment has thus been provided. However, the fact that more development work has been undertaken in various parts of the district in which nothing had been done for some time previously, is encouraging, especially as in several cases the opening of productive ore shoots is confidently expected.

Nelson.—In this division, too, the outlook has been improved by more work being done, both in camps within a few miles of the town of Nelson, and in the southern half of the division, about Ymir, Salmo, Sheep Creek and Erie. As yet the shipment of copper ore to smelting works has not been resumed, but several gold mines near Nelson are being worked, and it is expected that both the Silver King (silver-copper) mine and the Molly Gibson (silver-lead-zinc) mine will soon be again worked by the Consolidated Mining and Smelting Company.

Rossland.—The total quantity of ore from Rossland mines received at Trail during the week ended June 10th was the largest for any week since that ended March 11th of the current year. Of a total of 7,372 tons shipped early, in June, 3,680 tons was from the Consolidated Company's Centre Star-War Eagle group and 3,343 tons from its Le Roi mine, while 349 tons was from the Josie group of the Le Roi No. 2, Ltd. The total for the expired portion of the year—23 weeks—is 151,385 tons, as compared with 111,587 tons for the corresponding period of last year, an increase of 39,798 tons.

Under date of May 26th the Le Roi No. 2, Ltd., sent out from its London office the report of its Josie mine for the month of April, as received from its managers at Rossland, as follows: "Shipped to smeltery at Trail, 1,341 tons of ore and 49 tons of concentrate. Receipts were $20,327, being payment for 1,790 tons of ore shipped, and $1,185 for 108 tons of concentrate; sundry receipts were $704; total receipts, $22,216. The estimated working costs for the corresponding period were, for ore production $8,250, milling $550, development $2,400, stores purchased and unused $200, and ore tax $1,231; total $12,631. Balance of receipts over expenditures, $9,587."

The same company's report for March was as follows: "Shipped to smeltery at Trail, 1,500 tons of ore and 100 tons of concentrate. Receipts were $26,534, being payment for 1,791 tons of ore shipped, and $489 for 97 tons of concentrate; sundry receipts were $753; total receipts, $27,776. The estimated working costs for the corresponding period were, for ore production $4,750, milling $700, development $4,750, and stores purchased and unused $4,625; total $14,825. Balance of receipts over expenditures, $12,951."

February figures were: Total receipts, $19,655; expenditures, $9,250; balance, $10,405. January figures were: Total receipts, $18,875; expenditures, $9,375; balance, $9,500. For the four months ended April 30th the balance of receipts over expenditures, as shown above, was $42,441. On May 1st the company paid a dividend of one shilling a share on its 120,000 shares, total £6,000, or approximately $30,000, out of net profits made last year.

Ore Receipts at Trail.—Ore receipts at the Consolidated Mining and Smelting Company's smeltery at Trail are to a considerable extent indicative of the position in East and West Kootenay districts so far as concerns production of ores of which the chief marketable constituents are silver, lead, and zinc, in those of one class, and gold, silver and copper in those of another. Gold ores, milled at or near the place of production, are not included, for only table-concentrates, usually in comparatively small quantity, are sent from gold-saving mills to smelting works; yet even the quantity of concentrates received from them for smelting may tell of the relative productive activity of the gold mines. Of course, receipts at Trail from Ainsworth and Slocan mines do not show the quantity of silver-lead and silver-zinc ores mined in those divisions, for the reason that the greater part of such ores is concentrated at local mills. Most of the lead concentrate produced is sent to Trail, but the zinc concentrate is shipped to reduction works in the United States.

The following table shows the sources and quantities of ores received at Trail during twenty-one weeks of 1915, ended May 27th, and for the corresponding period of 1914, the production in which latter time, it should be remembered, was not affected by war conditions, as was that of the current year:

	Period Ended May 27, 1915. Tons	May 28 1914 Tons
East Kootenay	17,370	7,235
West Kootenay		
Ainsworth	1,662	7,741
Slocan	1,737	8,695
Nelson	1,644	10,759
Rossland	138,203	96,275
Lardeau	17	....
Boundary	220	130

Coast	101	782
Alberta	10	....
State of Washington (U.S.A.)	12,380	6,390
Totals	173,344	138,007

Of the substantial net gain of 35,337 tons made this year as compared with last, approximately 10,000 tons was from East Kootenay and 42,000 tons from Rossland—practically all from mines owned by the Consolidated Mining and Smelting Company—and 6,000 tons from the State of Washington; against these increases were decreases totalling 22,833 tons, including approximately 6,000 tons less from Ainsworth mining division (Bluebell and Consolidated Company's mines), 7,000 tons from Slocan mines (chiefly the Standard), 9,000 tons from Nelson division (in large part from the Silver King mine), and the small remainder from Coast mines. Now, however, that production has been resumed at the several mines in Ainsworth and Slocan divisions that were responsible for the decreases, the increase in output may be expected to be proportionately larger as from the beginning of June.

Ainsworth.—While production from this mining division in May was restricted to only two mines—the No. 1 which shipped 497 tons and the Early Bird 21 tons—there was progress at other properties. Mention has been made of a resumption of work at the New Canadian Metal Co.'s Bluebell, at which the concentrating plant as well as the mine will be in operation shortly. Other mines of the Consolidated Mining and Smelting Co., which owns the No. 1, are the Highland and the Banker-Maestro, both in the neighborhood of the town of Ainsworth and both expected to soon be again on the shipping list. The Florence Co.'s mine is reported to be developing satisfactorily with ore available for extraction. Little is heard of the Silver Hoard but much development work has been done, power equipment put in, and preparations made for maintaining an output of ore as soon as conditions shall be favorable for doing this. Work is again being done on several properties on Woodbury creek, near Ainsworth. West of Kaslo encouraging progress is reported from the Cork Province group on the south fork of Kaslo creek, where, as the Kootenaian has been informed, a shoot of galena ore of shipping grade has been found in an extension into the Cork claim of an old adit driven years ago in the Province ground. Encouraging accounts have also been received from the Ottawa mine on Paddy mountain, where the occurrence of more silver in some parts of the orebody than has been general is claimed. Arrangements are stated to have been made for examining with an R. Hallack & Co.'s Whitewater group, and there are other claims in that part of Ainsworth division on which development is also being done. As soon as the trail is hard enough, a pack-train will bring the silver ore mined at the Panama during the winter down from that mine in the mountains to the railway for shipment to the smeltery at Trail.

Slocan.—In the eastern part of this division, the Lucky Jim zinc-lead mine is again having development work done in it, the sanction of the court to its being given another chance to stave off threatened foreclosure by the mortgagee having been obtained. The sum of $5,000 has been deposited with the court and work is now being done under the direction of Mr. A. G. Larson, who, several years ago, was superintendent of the Le Roi mine, in Rossland camp. Shipment of zinc concentrate made at the Ivanhoe mill, Sandon, from ore from the Surprise mine, is stated to have been checked until such time as the smeltery in the United States to which that product was being shipped shall be prepared to again take it. The Slocan Star is being operated, and the Ruth concentrating mill should soon be running again after having been overhauled. Other properties around Sandon or Cody are having attention. Silverton camp, the Silverton Mines, Ltd., continues to operate its concentrating plant on Fourmile creek treating ore from its Hewitt-Lorna Doone mines, and development is being done as well on several smaller properties in the camp. The Standard Silver-Lead Mining Co. has put on one shift to run its concentrator at Silverton, and gradually mining operations are being extended in its group of mines which includes the Emily Edith, Standard, and Alpha properties. Lower down Slocan lake, in Slocan City mining division, the Enterprise is again being worked on lease, and other properties in the division are giving employment to a few men, but there has not been much ore produced this year from mines in this part of the Slocan district.

General Notes.

News from Boundary district gives the information that the Granby Company is working at ordinary full capacity of mines and smeltery and that all its employees are receiving increased wages; also that the Argo, E. P. U., Marjorie, Prince Henry, Skylark, and other small properties in Greenwood division, are being worked, each employing a few men. The Jewel gold-mine and stamp mill are being operated as usual. There is more being done in Franklin camp, north of Grand Forks, than in the early spring, and promising developments have been reported from that part of the district.

The latest list of ore receipts at Trail includes small shipments from the Iron Mask mine, near Kamloops, and the Monarch, near Field, the former of 72 tons and the latter of 32 tons. Both had been off the smeltery shipping list for some time.

In the Coast district, a discovery has been reported of molybdenite ore within a few miles of the head of Stave Lake and about seventy miles from the City of Vancouver. A story has been published in Vancouver of a [illegible] near Pitt Lake, nearer that city than the molybdenite find, a property on which it is alleged "there are veins of copper from four to five feet wide showing values of from 25 to 30 per cent [illegible]." Such stories [illegible] discoveries is not infrequently indulged in by newspaper men, or their misinformants, in that city.

NIPISSING MINES CO

Nipissing Mines Co. has a cash surplus of $1,400,000, the largest by $78,000 for more than a year. This financial [illegible] notwithstanding the [illegible] silver market. Forty cents per [illegible] was increased to dividends the amount [illegible] Nipissing's receipts [illegible] the metal purchases [illegible] higher prices.

[illegible] to June 21 about 3,000,000 [illegible] ore, including [illegible] and made the dividend [illegible] and $1,000,000.

Nipissing Mines [illegible] year's operations [illegible] end of 5 per cent. payable July 20 to [illegible] June 30.

THE ECONOMICAL USE OF COAL

Mr. Alexander Sharp has sent the following to the editor of the Daily Province, Vancouver. It refers particularly to the Vancouver district, but will prove interesting to many not resident there.

The increasing use of imported crude oil for fuel is having a very serious effect on the coal mining industry of British Columbia. As a result those interested in the business of coal mining are urging the Federal Government to put a tariff on imported fuel oil. On the other hand, the manufacturing interests, besides railway and steamship transportation companies operating in British Columbia, ask the Government not to impose a duty on crude oil.

I do not propose here to say anything for or against the imposing of a duty on crude oil, but rather to point out that when coal is properly assorted and manufactured, crude oil is not such a formidable competitor of coal as it is supposed to be, especially when oil is shipped from a distance, into a coal mining country.

Some few years ago, when oil was "struck" in large quantities in the State of Pennsylvania and other eastern states, it replaced coal for steam production to a great extent. In addition coal had to contend with the competition of gas from the natural gas wells, and electricity produced by water power. It was believed the days of "old King Coal" were gone forever. Coal mining stock fell to zero. In England oil fuel was also being largely used to the detriment of the coal trade.

The coal interests, of course, did not look for a tariff to be put on oil produced within their own states. In free trade England a tariff was out of the question. It was, therefore, up to the coal companies, with the assistance of the state, to work out their own salvation, and re-establish coal on the market as the cheapest, most lasting and safest of fuels.

Prior to the introduction of oil fuel, in the countries referred to, coal on reaching the surface from the mine was tumbled like debris into cars, etc., with scant ceremony, and supplied to the consumer practically as it left its natural bed. Except that some of the slack or dross coal would be screened from it, and an occasional piece of rock or slate picked out from among the coal. As a consequence the consumer was not infrequently supplied with coal containing from 20 to 25 per cent. ash. Under these circumstances, it was not a difficult matter for oil to replace coal, as a fuel, for manufacturing, railway and steamship transportation purposes.

Oil competition, however, sharpened the business wits of the coal operators, with the result that coal is no longer put on the market containing a large percentage of dust and foreign matter. It is freed of all debris, assorted into various sizing, such as lumps, eggs, walnuts, beans, peas and fines, suitable to the requirements of the consumer, that it may yield the greatest amount of heat units per ton of coal purchased. Fine coal which would often amount to as much as from 10 per cent. to 25 per cent. of the total quantity of coal mined, was either left in the mine, or dumped on the surface as waste. Now it is manufactured into briquetted fuel, bringing the highest fuel price on the market, adding to the profits of the coal operators and to the wealth of the nation.

It can be very readily understood that coal so cleaned, assorted and manufactured, has no trouble in dominating the fuel markets of the United States. According to the most recent report issued by the Bureau of Census on "Fuel Used for Manufacturing in U. S. A.," oil, including gasoline, only amounts to 3.44 per cent. of the total fuel used, Bituminous coal 76.93 per cent., anthracite coal 7.74 per cent., coke 10.43 per cent., wood 1.45 per cent., gas 0.01 per cent.

It would appear that oil fuel has replaced coal in British Columbia to the extent of 700,000 tons of coal annually. A few years ago oil was imported to the extent of only 5,000,000 gallons, now it is shipped in to the amount of 110,000,000 gallons per year. This no doubt was largely brought about by the unfortunate Vancouver Island strike and the unprepared condition in which some coal was supplied to the consumer two or three years ago, especially during the winter months, when the demand would be greater than the supply. The strike has passed away, and the quality of coal at present on the market is much improved, and if it continues to do so, the 110,000,000 gallons of oil now being used largely as a fuel will in time be reduced to a minimum. The coal operators of British Columbia have the matter very much in their own hands, as the operators had in Pennsylvania.

When we read how greatly the coal trade at the Cumberland mines has been adversely affected by the importation of oil fuel into the province, we wonder how it comes about that the iron works of Vancouver require to ship foundry coke from Pennsylvania, and the Granby Smelter Co. need to ship from Fernie and the State of Washington for their smelter at Granby Bay. The Cumberland mine coal, when cleaned and washed, can be manufactured into an excellent coke for all purposes, free of sulphur.

Under the present conditions of the coal trade, it appears anomalous that our iron works and smelters require to import coke and that the conservation commission should prohibit the use of coal being used on the railway locomotives within the province. The mining industry want fair play, and less of such restrictive and immatured legislative action.

In many parts of Europe and the United States coal is coming "to its own." Producer gas and by-products recovery plants are being operated with great success. It requires no prophetic eye to see that the day has all but arrived when the coal owners of British Columbia will derive their largest revenue from the by-products of the coal, and as a consequence the public will be supplied with a cheaper coal.

The Mond process, used largely abroad, yields from 80 to 90 lb. of sulphate of ammonia per ton of coal, in addition to the tar and gas from ordinary coal. Sulphate of ammonia is worth from $60 to $80 per ton, and the gas from these producers is being used in gas engines, iron melting, radiators, tube welding, indeed in every kind of manufacturing industrial works. The average price at which the gas was sold in 1912 (in a large manufacturing district in England) was 3.5 cents per 1,000 cubic feet.

In western Canada the by-product industry has developed less than in any other coal country. Indeed it is negligible.

In many coal districts by-product coke ovens are being used in the making of coke for metallurgical purposes, and the by-products of coal gas, tar, ammonia, benzol, etc., collected and turned into money. In Western Canada the old class of bee-hive coke ovens are still in general use, with the result that valuable by-products of the coal are lost.

Dr. Frank Adams, in an address before the Canadian Mining Institute, Toronto, March 4, 1915, in speaking on this subject said: "In the year 1912 405,457 tons

of coke were made in bee-hive ovens in Alberta and British Columbia, representing a waste of approximately 12,569,899 lb. of ammonium sulphate, and 43,383,899 gallons of tar, not to mention the benzol and other minor products, and the immense amount of gas."

There is no coal in the world richer in by-products than the coal of British Columbia, the fines that has hitherto been looked upon as waste at some of our coal mines, if properly cleaned and made into briquettes, mixed with a suitable binder, would produce a fuel having a calorific power equal to the best imported anthracite coal. The Germans use briquettes in their torpedo boats.

The sulphate of ammonia obtained from coal is generally in proportion to the nitrogen contents. The average nitrogen in our coal is about 1.4 per cent., which is equal to 85 lb. of ammonia to the ton of coal.

According to chemical analysis, the richest by-product coal in Canada is the coal of the Nicola Valley Coal and Coke Co., Limited, Merritt, which contains 2 per cent. nitrogen, besides the tar and gas.

It is probable that the future of this valuable coal area may lie in the extraction of this sulphate of ammonia, gas, oils, etc. (in addition to its being used as a fuel), and the gas piped down to Vancouver and the Fraser River valley. It is being done elsewhere and why not in British Columbia?

The South Staffordshire Mond Gas Company furnishes the public with such a producer gas. The charter granted them by Parliament grants them the right to supply gas over an area of 123 square miles. In this area there are six corporations (including Wolverhampton), the gas for power purposes is used by 100 miles of railways, as many miles of canals, fully 2,000 public works. The price of gas is 5½ cents to 3½ cents per 1,000 cubic feet. At Indianapolis by-product coke-oven gas is being supplied for town use at 57 cents per 1,000 cubic feet; in other American cities at a much lower rate.

If gas from a by-product plant at Nicola Valley is ever used in Vancouver and district, the smoke from California crude oil will no longer pollute the atmosphere or the blue waters of the Inlet. The business artery of the district will throb with a fullness of industrial life. Space in our business blocks will be rented at a premium and the home filled with artisans.

COAL MINING IN WASHINGTON.

The report of the State Inspector of Coal Mines, State of Washington, for the biennial period ended December 31, 1914 was issued recently. The inspector, Mr. James Bagley, gives the following information in the first part of his comprehensive introduction.

"The coal production of Washington showed a marked increase in 1913 over the previous year, when 3,831,647 short tons was produced against 3,346,946 short tons for 1912, an increase of 484,701 short tons, or 14.4 per cent. The large increase in the consumption of Washington coal in 1913 was due in considerable measure to labor troubles in the coal mines on Vancouver island, in British Columbia, when a large amount of Washington coal was shipped into the market formerly supplied by the British Columbia mines. The figures for 1914 are not so encouraging, only 3,040,861 tons having been produced, showing a loss of 791,786 short tons, or about 26 per cent. decrease compared with 1913. The total quantity for the biennial period was 6,872,008 short tons as compared with 6,895,268 short tons for the previous two years, or a loss of 23,260 short tons for the biennial period. The average value of coal at the mine was $2.60 in 1913 and $2.35 in 1914. The total value of coal at the mine in 1913 was $9,965,362.50, and in 1914 $7,142,084.

"The production of coke in 1913 broke all previous records when 75,732 short tons was produced at an average value of $5.62 short ton at the mine. The production for 1914 shows an increase over 1913, 78,573 short tons having been produced for the year. The average value at the mine decreased to $5.15 per short ton. The total value of the coke production was $425,632 in 1913 and $404,126 in 1914. The coke production of the state is confined to Pierce county. Carbonado, Wilkeson and Fairfax mines are the chief producers.

"The total number of employees in the industry was 6,065 in 1913 and 5,647 in 1914, an average of 5,856 for the two years. The average for the preceding two years was 5,727.

"The statistics for the past ten years show that the coal mining industry has not advanced as rapidly as the growth of the state should warrant; in fact the production for last year is about the same as ten years ago. This condition is due to the substitution of oil for coal as fuel in many of the industries where coal formerly found a ready market. The railways in Washington, which a few years ago were using coal almost exclusively, are now using large quantities of fuel oil. Many of the steamships running out of Puget Sound and coast ports are using oil for fuel. Some of the large steamers in the freight and passenger traffic running between California and Puget Sound ports were converted from coal into oil burners during the last two years. Electricity is also replacing coal in a great many of the manufacturing plants in the Puget Sound district. The natural resources of Washington enable the power companies to generate power at a very low cost to the consumer.

"The prediction by those best informed is, that there will not be any great increase in the consumption of Washington coal while California fuel oil remains at the present price. Should the supply of California fuel oil decrease, the Washington coal mines would be worked to their full capacity."

Information relative to accidents at coal mines includes statistics showing that during 1913 and 1914 there were 39 fatal and 1,604 non-fatal accidents. The number of fatalities compares with 41 for the previous biennial period. There were not any serious labor troubles, only a few strikes of short duration at some of the mines. One hundred and forty-two men received from the U. S. Bureau of Mines certificates of competency in mine-rescue and first-aid training, and 118 took first-aid training only.

ALIEN ENEMIES AT COBALT.

Cobalt, June 23.

After considerable agitation from various quarters regarding the alien enemies in the camp, definite action has been taken and a lengthy petition signed by residents of Cobalt and other northern towns and of the entire district. At a meeting of the local Board of Trade last night, it was decided to send a deputation to Ottawa, asking that a general internment of aliens be begun immediately. It is pointed out that the subjects of countries at war with Great Britain and her allies are under no apparent control in the camp and in a position to commit acts detrimental to the welfare of the country.

U. S. COAL TRADE IN 1914.

Coal production in the United States in 1914 compares as follows in net tons:

	*1914	1913
Anthracite	91,000,000	91,000,000
Bituminous	420,000,000	479,000,000
Total	510,000,000	570,000.000

*Estimated.

Loss has thus been due in the soft coal trade to the decline of manufacturing and of the greatest of coal consuming trades, iron, steel and coke, which has heavily hurt the coal trade.

Pennsylvania coal tax of ten cents a ton remains unsettled and is being tested in the courts.

Coal production in 1913 was 570,048,125 short tons, an increase over 1912 of 35,581,545 tons, or nearly 7 per cent. Value of this coal was $760,488,785. Per capita production was 5.85 tons.

The year was important in the renewal of the biennial agreement for wages of miners.

Anthracite trade has been marked by the steadiness which is now the characteristic of the hard coal production.

Anthracite mines have produced about 91,000,000 net tons. Of this amount about 15 per cent. is consumed for operative and local heating purposes, leaving over 70,000,000 tons for distribution. Prices have held firm and hard coal has been the backbone of a coal trade that under the pressure of extraordinary conditions might easily have yielded to untoward circumstances.

Conditions in the lake trade have been unpropitious since the start of the season. Decrease in tonnage which passes through the Soo gateway was over 525,000 tons in anthracite coal and almost 3,500,000 tons in bituminous, a total of almost 4,000,000 tons.

Decrease in dangers and in costs for the coal fleet around the northern capes by protection of the Cape Cod canal has not materialized fully as yet. Barges for coal traffic draw from 19 to 22 feet and the canal is fully prepared for only 15 feet of draft. Only three-quarters of a mile remains to be dredged in the middle of the canal to depth required for coal barging of the large size and this will help freightage of coal and reduce prices and so stimulate the coal trade within the coming and subsequent years.

Disappointment in the coal trade has been helped by the failure of export trade to develop in any way commensurately with expectations produced by the war. But there is confident feeling that the United States will soon establish large export relations and there are favorable indications of increasing purchasing of American coals.

Labor conditions have been remarkable in their freedom from difficulties. There have been two notable exceptions. The strike in Colorado has continued to the great detriment of the industries of that state and to the embittering of trade relations. This has caused a decrease of about 14 per cent. in production. In the large eastern Ohio field there has been failure to adjust differences whose actual spread is slight, but where the principles involved cause divergence which it seems impossible to compromise. Reduction of production has lent a certain strength to the situation in a year that has struggled against very adverse factors. —Boston News Bureau.

JACKLING PROPERTIES.

Butte, Mont., June 11, 1915.

D. C. Jackling, who was in Butte to inspect the Butte & Superior mine and mill with Charles Hayden, of Boston, and other directors of the Jackling companies, in an interview, said:

"We have decided to proceed at once with the development of the Butte-New York properties. The Butte & Superior Co. owns the controlling interest in the stock of the Butte-New York Copper Co., which controls what is known as the Butte-Milwaukee group of claims. These claims lying east and north from the Black Rock will be developed as rapidly as possible. With the present price of spelter and copper we are certainly going to devote our energies to mining all that we can of both in the companies with which I am connected. One of the hardest problems the Butte & Superior Co. has had to face was that of finding a way to handle our concentrates. The smelter capacity of the country for the handling of spelter is limited, and we found this a handicap. Happily we have been able to make the needed arrangements, so that the company was not compelled to curtail to any material extent the output of the Black Rock mine and the Butte & Superior mill. We will go right ahead now with further developments of the ore reserves. The Butte-New York claims are zinc properties and we expect to keep ore reserves well ahead. The development will be carried on from our 1,200-ft. level in the Butte & Superior which runs into the Butte-New York ground and also from other levels. All of our companies are working to meet the big demand for spelter and copper that has sprung up so suddenly. At present prices they can make large profits and they are aiming to meet the demand for the metals, to their capacity. Utah Copper and all the porphyries are now running to the very limit of their capacity. They have been steadily increasing the amount of copper produced while the cost of production is now reduced to the lowest point these companies have ever known. Butte & Superior was making money when spelter was selling at five cents a lb. Now that the price of spelter is way up around 24 cents a lb., with demand for it far into the coming months, the company is making a showing that no one even dreamed would be possible six months ago.

"We will sail for Alaska on June 11, according to present plans. The new mill there is making a fine record. It has already handled 50 per cent. more ore than the supposed capacity when it was built. We are more than satisfied with the results shown there. In all our mining operations we are making efforts to meet the conditions that are arising. The war in Europe is causing situations that are unprecedented. In both spelter and copper the smelting operations are giving more concern than the mining part of it. It is not at all unlikely that additional smelting capacity will be required if conditions continue as at present. The improvements made in the line of leaching plants and many other improvements that could be mentioned are receiving greater attention than ever since copper has risen so rapidly and the demand has increased. The general mining outlook is splendid. That expresses it."

Casey's View.

"O'im a paceable man an' I hope that Oi may niver be anything else."

"Then you don't want war with Germany?"

"Oi do not. But, begorry, if Jarmany wants war wid us, Oi t'ink we ought to be neighborly an' accommodatin'."—Boston Transcript.

THE KAISER HAS NO INVESTMENTS IN CANADA

The following communication from Mr. Alvo von Alvensleben, formerly extensively connected with real estate transactions and various company promotions in British Columbia, but now resident in Seattle, Washington, appeared in a recent issue of "Coal Age," published in New York City:

"My attention has been drawn to the industrial news item published in 'Coal Age,' April 24, page 742, which is evidently taken from numerous similar publications that have appeared in various newspapers on the Pacific Coast and which contained a number of mis-statements, that I have been obliged to correct in the most emphatic terms practically each time they have appeared. Notwithstanding this fact, many of the papers have persisted in referring to the story again and again, presumably because they consider it interesting reading. In doing so, they ignore the fact that such a publication of an untruth has the effect to prejudice unfairly important industrial interests both of myself and others associated in the same enterprise.

Permit me to assert briefly the following facts: His Majesty, William II., Emperor of Germany, so far as I know, has never directly or indirectly, invested one cent in Canada, either through me or anybody else. Furthermore, my associates and I have never had $5,000,000 invested in Canadian coal fields. Our investments scarcely amount to $1,000,000. There is no reason why these investments should be 'irretrievably lost,' inasmuch as they are in companies formed under a British Columbia charter, and the shareholders comprise Germans, Canadians, Americans and Englishmen."

The item in "Coal Age" to which Mr. von Alvensleben makes reference was as follows:

"Spokane, Wash.—The sum of five million dollars, invested in Canadian coal fields by the Count Alvo Alvensleben, of Seattle, will likely be irretrievably lost because the Count was unfortunate enough to interest Kaiser Wilhelm in his mining enterprise. The Count, too, is German, and since the war broke out, he has confined his business to this side of the line. He is the dominant figure in the Issaqua and Superior coal districts of Washington."

Incidentally, it may be mentioned, Mr. von Alvensleben appears to suggest that he is not entitled to be called "Count," which title, he says, "the press of this country has invariably insisted in conferring upon me."

It may be of interest to add that on June 1 the unopposed application for the foreclosure of an agreement to purchase a number of timber limits in British Columbia, sold by the Red Cliff Land and Lumber Company, of Duluth, to the Alvo von Alvensleben Company, was granted in Vancouver, B.C., by a Supreme Court judge. It was stated that the von Alvensleben Company had paid $800,000 on account of the total purchase price of $2,200,000, and that there was overdue $100,000 on the principal, $100,000 as interest, and $9,000 on unpaid taxes.

Ottawa, June 12.—It is stated from an authoritative source that the Government is about to decide on the impending change in the Cabinet. The Hon. Louis Coderre is, it is said, to be appointed a judge of the Superior Court for the District of Mont Laurier, succeeding Mr. Justice Charyau, who will be transferred to Montreal to replace the late Mr. Justice Beaudin. Mr. J. M. Tellier has been again asked to accept the portfolio of Secretary of State, which Mr. Coderre is to resign, but has not yet given his answer.

Mr. Coderre is Secretary of State and Minister of Mines.

LIEGE.

Betwixt the Foe and France was she—
France the immortal, France the free.
The Foe, like one vast living sea,
Drew nigh.

He dreamed that none his tide would stay;
But when he bade her to make way,
She, through her cannon, answered, "Nay,
Not I!"

No tremor and no fear she showed:
She held the pass, she barred the road,
While Death's unsleeping feet bestrode
The ground.

So long as deeds of noblest worth
Are sung mid joy, and tears, and mirth,
Her glory shall to the ends of Earth
Resound.

Watched by a world that yearned to aid,
Lonely she stood but undismayed,
Resplendent was the part she played,
And pure.

Praised be her heroes, proud her sons!
She threw her souls into the guns.
Her name shall, with the loveliest ones,
Endure.

—William Watson.

TWO KILLED AT KERR LAKE.

Cobalt, June 27.

A verdict of accidental death was rendered yesterday at the inquest into the death of W. S. Eldridge and W. B. Foote, who were instantly killed in a stope of the Kerr Lake mine here on Friday afternoon. They walked on to a set of loaded holes just as the charge exploded. The remains of Eldridge were shipped to relatives in Philadelphia, Silver Lodge Masons taking charge of the funeral arrangements here, and the remains of Foote were sent to his only near relative, his mother, living in Geneva, N.Y. Eldridge was the engineer of the mine, and Foote was a wealthy capitalist interested in several mining properties in Porcupine and in British Columbia. W. S. Eldridge was a popular young mining engineer, a graduate of the Montana College of Mines.

BOOK REVIEW.

PRACTICAL OIL GEOLOGY The Application of Geology to Oil Field Problems By Dorsey Hager McGraw Hill Book Co.—For sale by Book Department, Canadian Mining Journal.

The author's endeavor has been to furnish the oil man with a clear, concise and practical work on the occurrence of oil and its extraction. Most books on oil are by English writers whose experience has been largely in Europe and Asia. This is essentially an American book.

The various chapters are headed as follows: Formation of origin and reservoir and formation properties; Stratigraphy; Structural Geology; Prospecting and Mapping; Locating Drill Hole; Some Factors in Oil Well Drilling; Factors in Oil Production; Water Conditions.

MARKETS

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	New York, cents.	London, pence.
June—		
9	49⅝	23½
10	49¼	23 5/16
11	49⅜	23⅜
12	49⅜	23⅜
14	49½	23 7/16
15	49¼	23⅜
16	49⅛	23⅜
17	49⅛	23 5/16
18	49⅛	23⅜
19	..	..
21	..	..
22	48⅞	23¼

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(Courtesy of J. P. Bickell & Co., Standard Bank Building, Toronto, Ontario.)

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	Bid.	Ask.
Alaska Gold	37.50	38.25
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California Oil	279.00	281.00
Chino Copper	48.50	48.62½
Giroux Copper	.50	1.50
Goldfield Cons	1.50	1.56¼
Green Can.	40.00	42.00
Granby	88.50	89.00
Inspiration Copper	31.87½	32.00
International Nickel	150.00	151.00
Miami Copper	25.87½	26.00
Nevada Copper	14.87½	15.00
Ohio Oil	135.00	137.00
Ray Cons. Copper	14.00	14.12½
Standard Oil of New York	185.00	187.00
Standard Oil of N. J.	401.00	403.00
Standard Oil (old)	1350.00	....
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Tonopah Mining	7.00	7.12½
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McIntyre	.40½	.41
Moneta	.05	.05½
Pearl Lake	.01¼	.01½
Porcupine Gold	½	¾
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June 24—(Quotations from Elias Rogers Co., Toronto)—
- Coal, anthracite, $7.50 per ton.
- Coal, bituminous, $5.25 per ton.

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June 24, 1915—Connellsville Coke (f.o.b. ovens)—
- Furnace coke, prompt, $1.50 per ton.
- Foundry coke, prompt, $2.00 to $2.40 per ton.

June 24, 1915—Tin, straits, 41.30c.
- Copper, Prime Lake, 20.00 to 20.50c.
- Electrolytic copper, 19.75 to 20.00c.
- Copper wire, 21.50 to 22.00c.
- Lead, 5.35 to 5.45c.
- Spelter, 18.00 to 18.50c.
- Sheet zinc (f.o.b. smelter), 30.00c.
- Aluminum, 31.00 to 33.00c.
- Nickel, 50.00c.
- Platinum, soft, $40 per oz.
- Bismuth, $2.75 to $3.00 per lb.
- Quicksilver, $95.00 per 75 lb. flask.

In the limited amount of gas which is found in the Petrolia field, Ontario, a considerable proportion of hydrogen sulphide is present; consequently, the Government gas inspector has notified the company and consumers that gas must not be used for illuminating purposes in Petrolia, unless it be first purified. In Chatham and in some other localities purification is accomplished by the companies through the use of individual purifiers in each house.

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

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PUBLICATIONS

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Most of the older reports are out of print, but they may usually be found in public libraries, libraries of the Canadian Mining Institute, etc.

REPORTS RECENTLY ISSUED:

CANADA
Memoir 59. Coal Fields and Coal Resources of Canada, by D. B. Dowling.
Summary Report of the Geological Survey for the year 1913.
NEW BRUNSWICK and NOVA SCOTIA
Memoir 20. Gold fields of Nova Scotia, by W. Malcolm.
Memoir 60. Arisaig-Antigonish District, Nova Scotia, by M. Y. Williams.
Memoir 41. The "Fern Ledges" Carboniferous flora of St. John, New Brunswick, by Marie C. Stopes.
QUEBEC
Memoir 64. Preliminary Report on the Clay and Shale Deposits of the Province of Quebec, by J. Keele.
Memoir 39. Kewagama Lake Map-Area, Quebec, by M. E. Wilson.
ONTARIO
Memoir 57. Corundum, its Occurrence, Distribution, Exploitation and Uses, by A. E. Barlow.
Memoir 40. The Archaean Geology of Rainy Lake Re-studied, by Andrew C. Lawson.
Museum Bulletin No. 8. The Huronian Formations of Timiskaming Region, Canada, by W. H. Collins.
NORTH-WEST PROVINCES
Memoir 53. Coal Fields of Manitoba, Saskatchewan, Alberta and Eastern British Columbia (Revised Edition) by D. B. Dowling.
Memoir 65. Clay and Shale Deposits of the Western Provinces (Part 4), by H. Ries.
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BRITISH COLUMBIA
Memoir 32. Portions of Portland Canal and Skeena Mining Divisions, Skeena District, B.C., by R. G. McConnell.
Memoir 56. Geology of Franklin Mining Camp, British Columbia, by Charles W. Drysdale.
Museum Bulletin 11. Physiography of the Beaverdell Map Area and the Southern Part of the Interior Plateaus of British Columbia, by Leopold Reinecke.
YUKON AND NORTH-WEST TERRITORIES
Memoir 50. Upper White River District, Yukon, by D. D. Cairnes.
Memoir 67. The Yukon-Alaska International Boundary, between Porcupine and Yukon Rivers, by D. D. Cairnes.

MAPS RECENTLY ISSUED:

CANADA
Map 91A. Geological map of the Dominion of Canada and Newfoundland. Scale 100 miles to 1 inch.
NEW BRUNSWICK AND NOVA SCOTIA.
Map 27A. Bathurst and vicinity, Gloucester County, New Brunswick. Geology.
Map 39A. Geological Map of Nova Scotia.
Map 121A. Francy Mine and Vicinity, Victoria County, N. S.
QUEBEC
Map 95A. Broadback River, Mistassini Territory, Quebec. Geology.
Map 100A. Bell River, Quebec. Geology.
ONTARIO
Map 124A. [illegible]
Map 49A. [illegible]
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Map [illegible]
Map 117A. Wood Mountain Coal Area, Saskatchewan.
BRITISH COLUMBIA
Map 44A. [illegible]
Map 70A. Victoria sheet, Vancouver Island. Geology.
Map 72A. Saanich sheet, Vancouver Island. Geology.
Map 109A. Prescott, Paxton and Lake Mines, Texada Island. Topography.
YUKON AND NORTH-WEST TERRITORIES
Map 113A. Canadian routes to White River District, Yukon, and to Chisana District, Alaska.

NOTE.—Maps published within the last two years may be had, printed on linen, for field use. A charge of ten cents is made for maps on linen.

The Geological Survey will, under certain limitations, give information and advice upon subjects relating to general and economic geology. Mineral and rock specimens when accompanied by definite statements of localities, will be examined and their nature reported upon. Letters and samples that are of a Departmental nature, addressed to the Director, may be Mailed O.H.M.S. free of postage.

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Mussens, Ltd.

Cranes—Overhead Traveling—
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Boving & Co. of Canada, Ltd.

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Mussens, Ltd.
Allan, Whyte & Co.
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B. Greening Wire Co., Ltd.

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S. Flory Mfg. Co.
M. Beatty & Sons, Ltd.
Mussens, Ltd.

Diamonds (for Diamond Drills)—
Abe. Levine.

Diamond Drill Contractors—
Diamond Drill Contracting Co.
Smith and Travers.

Dredging Machinery—
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M. Beatty & Sons.
Mussens, Ltd.
Boving & Co. of Canada, Ltd.

Dredging Ropes—
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Fraser & Chalmers of Canada, Limited.

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Can. Ingersoll-Rand Co., Ltd
Mussens, Ltd.
Jeffrey Mfg Co.
Sullivan Machinery Co.
Peacock Bros.
Northern Canada Supply Co.

Drills—Core—
Can. Ingersoll-Rand Co., Ltd
Standard Diamond Drill Co.

Drills—Diamond—
American Diamond Rock Drills.
Sullivan Machinery Co.
Northern Canada Supply Co.

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Sullivan Machinery Co
Mussens, Ltd.

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Curtis & Harvey (Canada), Ltd.
Canadian Explosives.
Northern Canada Supply Co.

Dynamos—
Northern Electric Co., Ltd.

Electric Cranes—
Mussens, Ltd.

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Mussens, Ltd.
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Smart-Turner Machine Co.
Peacock Bros.

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M. Beatty & Sons
Smart-Turner Machine Co
Peacock Bros.
Boving & Co. of Canada, Ltd

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Lymans, Ltd.
Mussens, Ltd.

Furnaces—Electric—
Boving & Co. of Canada, Ltd.

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Peacock Bros.
Curtis & Harvey (Canada), Ltd.
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Northern Canada Supply Co.

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Peacock Bros.
Mussens, Ltd.
S. Flory Mfg. Co.
Jones & Glassco.
M. Beatty & Sons
Fraser & Chalmers of Canada, Limited
Northern Canada Supply Co.

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Peacock Bros.
Mussens, Ltd.
Sullivan Machinery Co.
Fraser & Chalmers of Canada, Limited
Can. Ingersoll-Rand Co.
M. Beatty & Sons.

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Canadian H. W. Johns-Manville Co., Ltd.
Mussens, Ltd.
Northern Canada Supply Co.

Jacks—
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Can. Ingersoll-Rand Co., Ltd
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Jigs—
Mussens, Ltd.
Roberts & Schaefer Co.

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Mussens, Ltd.
Northern Canada Supply Co.

Lamps—Safety—
Mussens, Ltd.
Canadian Explosives
Peacock Bros.

Link Belt—
Northern Canada Supply Co
Jones & Glassco.

Locomotives—Electric—
Mussens, Ltd.
Jeffrey Mfg. Co.

Locomotives—Steam—
Mussens, Ltd.

Metal Merchants—
Henry Bath & Son.
Geo. G. Blackwell & Co.
Consolidated Mining and Smelting Co. of Canada.
Canada Metal Co.
C. L. Constant Co.

Monel Metal—
International Nickel Co.

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Northern Electric Co., Ltd.
Peacock Bros.

Mule Stands—
Dodge Mfg. Co., Ltd.

Nickel—
International Nickel Co.

Ore Sacks—
Northern Canada Supply Co.

Ore Testing Works
Ledoux & Co.
Can. Laboratories.
Milton Hersey Co., Ltd.
Campbell & Deyell.

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Geo. G. Blackwell.
Consolidated Mining and Smelting Co. of Canada.
Orford Copper Co.
Canada Metal Co.

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B. Greening Wire Co., Ltd.
Fraser & Chalmers of Canada, Limited
Northern Canada Supply Co.
Hendrick Mfg. Co.

Pick Machines—
Sullivan Machinery Co.

Picks—Steel—
Mussens, Ltd.
Thos. & Wm. Smith.
Peacock Bros.

Pillow Blocks—
Dodge Mfg. Co., Ltd.

Pipes—
Boving & Co. of Canada, Ltd.
Consolidated M. & S. Co.
Peacock Bros.
Mussens, Ltd.
Northern Canada Supply Co.
Smart-Turner Machine Co.

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Can. H. W. Johns-Manville
Mussens, Ltd.
Northern Canada Supply Co

Pneumatic Tools—
Can. Ingersoll-Rand Co., Ltd
Jones & Glassco.

Producer—Gas—
Mussens, Ltd.

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Mussens, Ltd.
Fraser & Chalmers of Canada, Limited

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Northern Canada Supply Co.
Dodge Mfg. Co., Ltd.

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Mussens, Ltd.
Northern Canada Supply Co
Peacock Bros
Can. Ingersoll-Rand Co., Ltd.
Fraser & Chalmers of Canada, Limited

Pumps—Centrifugal—
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Mussens, Ltd.
Smart-Turner Machine Co
Peacock Bros.
Thos. & Wm. Smith
M. Beatty & Sons
Can. Ingersoll-Rand Co., Ltd
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Mussens, Ltd.
Canadian Ingersoll Rand Co., Ltd.
Fraser & Chalmers of Canada, Limited

Pumps—Pneumatic—
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Smart-Turner Machine Co.
Can. Ingersoll-Rand Co., Ltd

Pumps—Steam—
Can. Ingersoll-Rand Co., Ltd
Mussens, Ltd.
Thos. & Wm. Smith.
Northern Canada Supply Co.
Smart-Turner Machine Co.

Pumps—Turbine—
Boving & Co. of Canada, Ltd.
Mussens, Ltd.
Canadian Ingersoll-Rand Co., Ltd.
Fraser & Chalmers of Canada, Limited

Pumps—Vacuum—
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Quarrying Machinery—
Mussens, Ltd.
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Canadian Bridge Co.
Mussens, Ltd.
Nicholson Graham Steele Co.
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Rope Blocks—
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Rope Wheels—
Dodge Mfg. Co., Ltd.

Rope Dressing—
Dodge Mfg. Co., Ltd.

Rope—Manilla and Jute—
Jones & Glassco.
Mussens, Ltd.
Peacock Bros.
Northern Canada Supply Co.
Allan, Whyte & Co.
Thos. & Wm. Smith, Ltd.

Rope—Wire—
B. Greening Wire Co., Ltd
Allan, Whyte & Co.
Northern Canada Supply Co.
Thos. & Wm. Smith.
Fraser & Chalmers of Canada, Limited
Mussens, Ltd.

Samplers—
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C. L. Constant Co
Lymans & Co.
William Harvey & Co.
Thos. Heys & Son

Screens—
B. Greening Wire Co., Ltd
Mussens, Ltd.
Dodge Mfg. Co.
Northern Canada Supply Co.
Peacock Bros.
Fraser & Chalmers of Canada, Limited

Screens—Crane Patent Flanged Lip—
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Smart-Turner Machine Co.
Peacock Bros.

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Slime Tables—
James Ore Concentrator.

Smelting Machinery—
Mussens, Ltd.
Peacock Bros.
Fraser & Chalmers of Canada, Limited

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Dodge Mfg. Co., Ltd.

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Dodge Mfg. Co., Ltd.

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Canadian H. W. Johns-Manville Co., Ltd.
Hendrick Mfg. Co.

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Fraser & Chalmers of Canada, Limited

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Peacock Bros.
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Northern Canada Supply Co.
B. Greening Wire Co., Ltd

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Northern Electric Co., Ltd.
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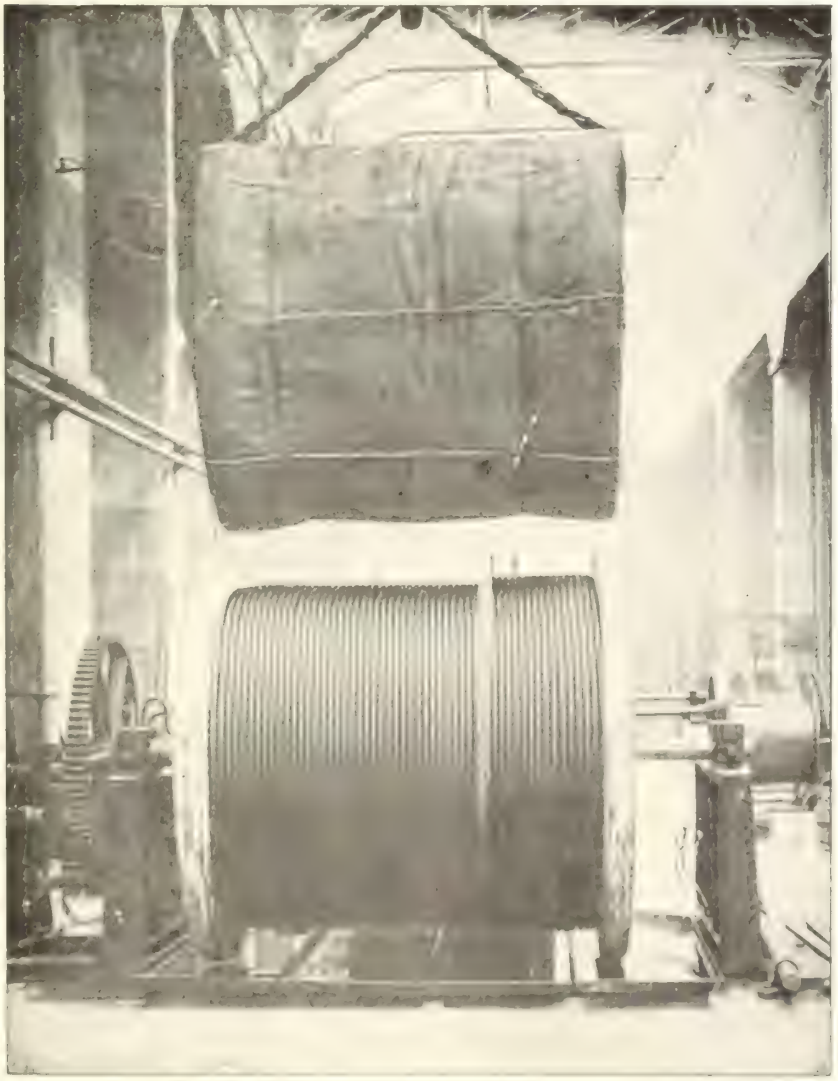

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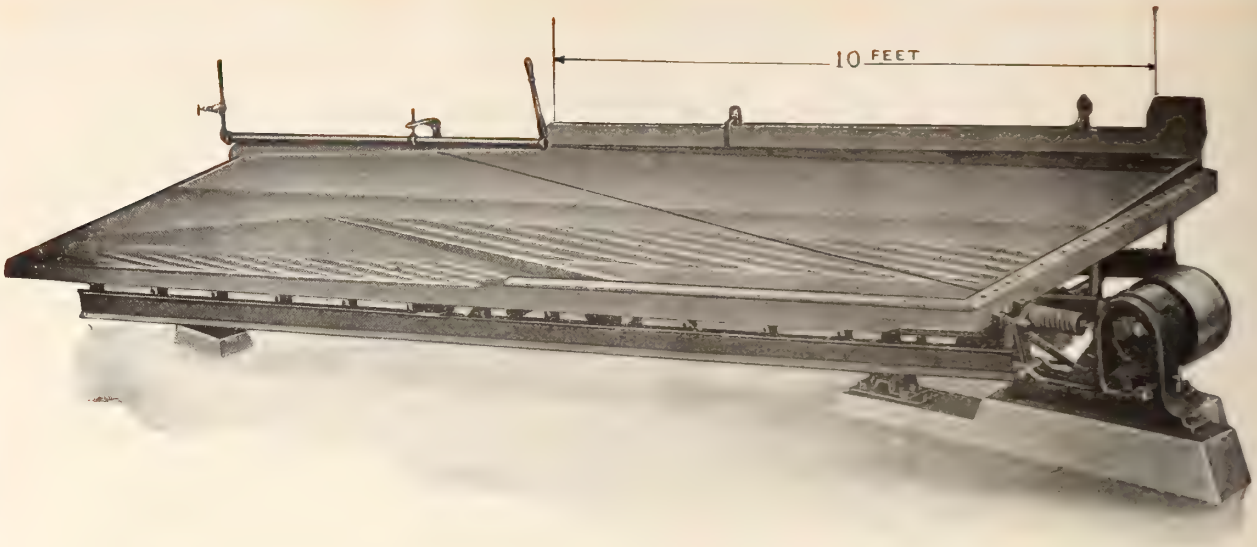

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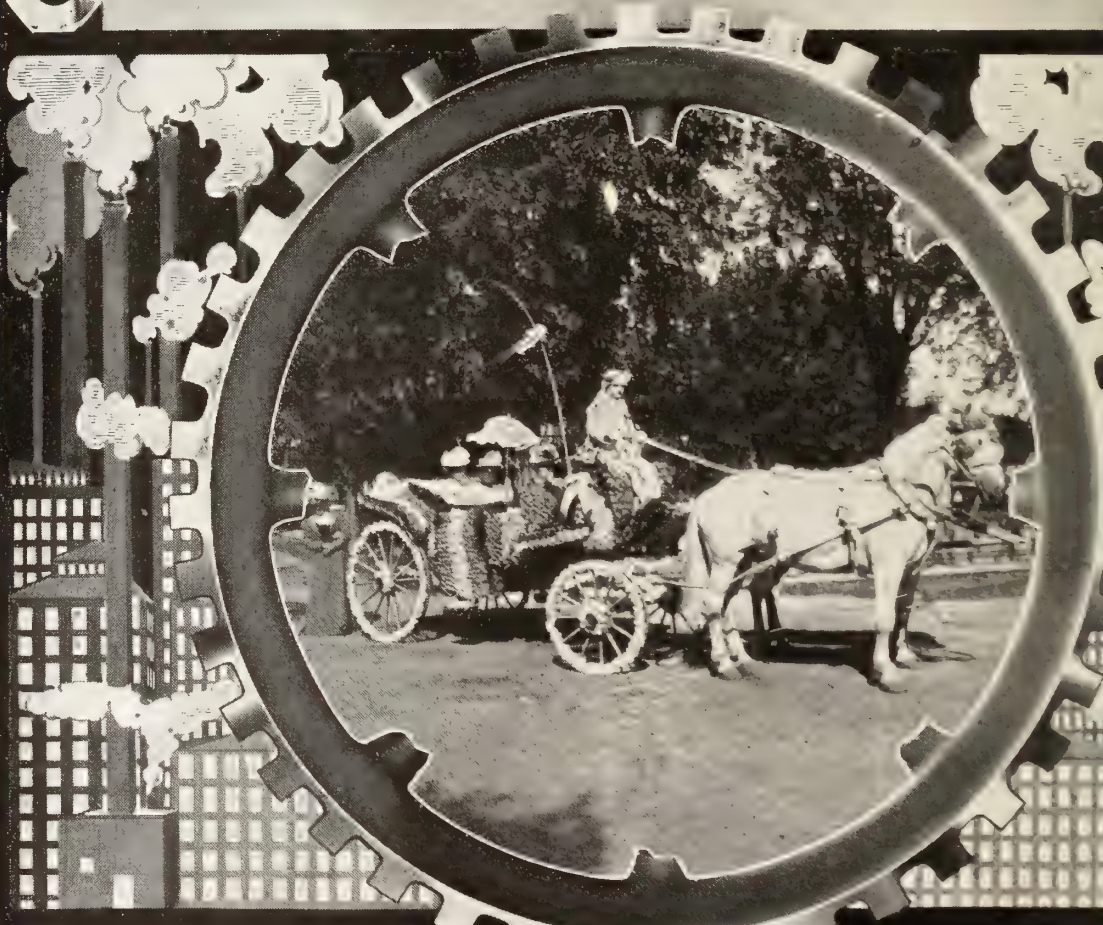

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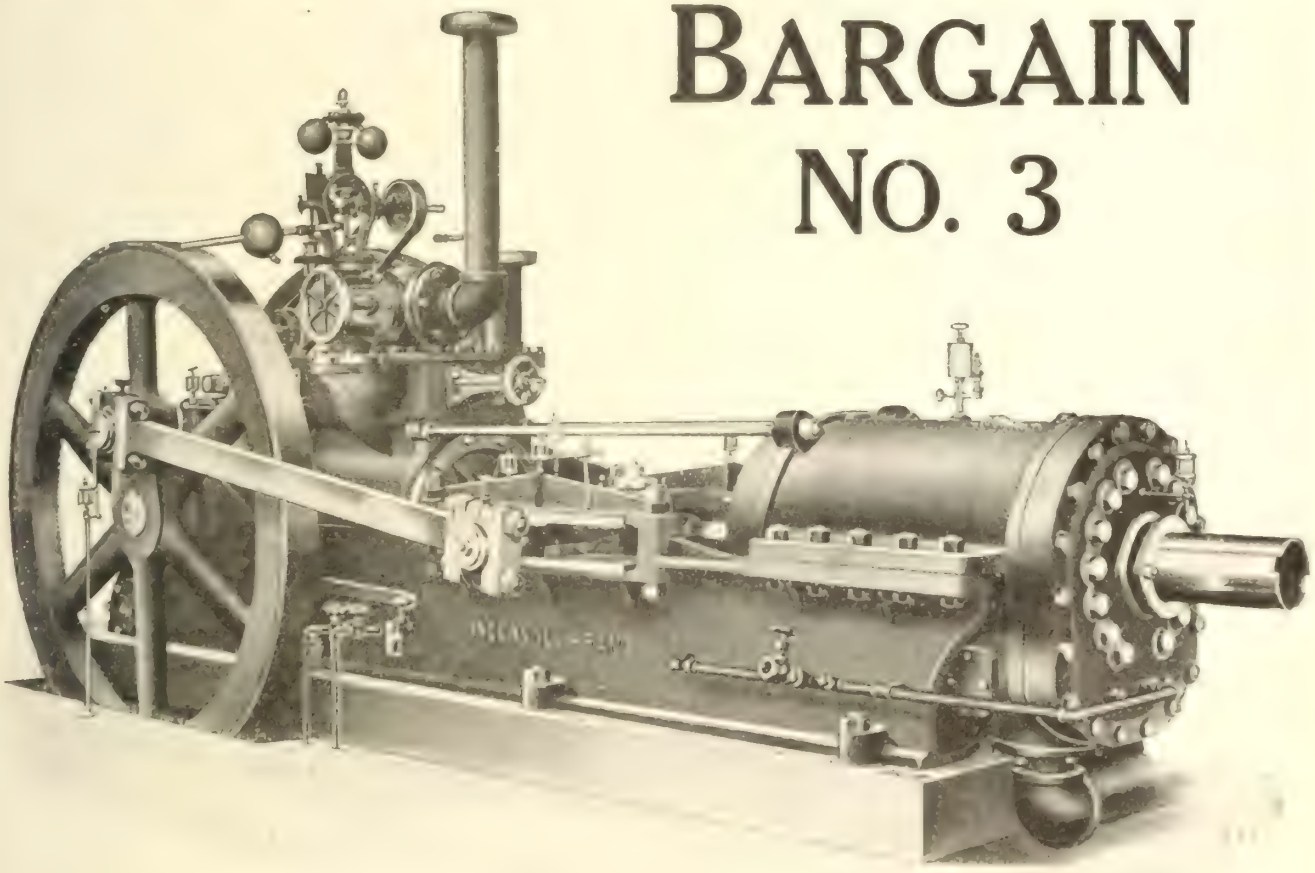

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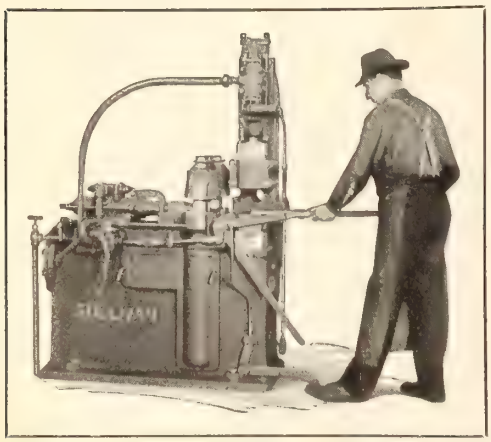

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BULLETIN 672

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Department of Colonization, Mines and Fisheries

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WORKING CONDITIONS. During the first six months following the staking of the claim, work on it must be performed to the extent of at least twenty-five days of eight hours.

SIX MONTHS AFTER STAKING. At the expiration of six months from the date of the staking, the prospector, to retain his rights, must take out a mining license.

MINING LICENSE. The mining license may cover 40 to 200 acres in unsurveyed territory. The price of this license is Fifty Cents an acre per year, and a fee of $10.00 on issue. It is valid for one year and is renewable on the same terms, on producing an affidavit that during the year work has been performed to the extent of at least twenty-five days labour on each forty acres.

MINING CONCESSION. Notwithstanding the above, a mining concession may be acquired at any time at the rate of $5 an acre for SUPERIOR METALS and $2 an acre for SUPERIOR MINERALS.

The attention of prospectors is specially called to the territory in the North-Western part of the Province of Quebec, north of the height of land, where important mineralized belts are known to exist.

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The Bureau of Mines at Quebec will give all the information desired in connection with the mines and mineral resources of the Province, on application addressed to

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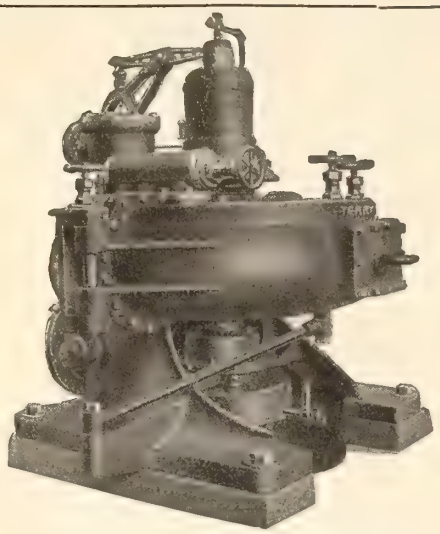

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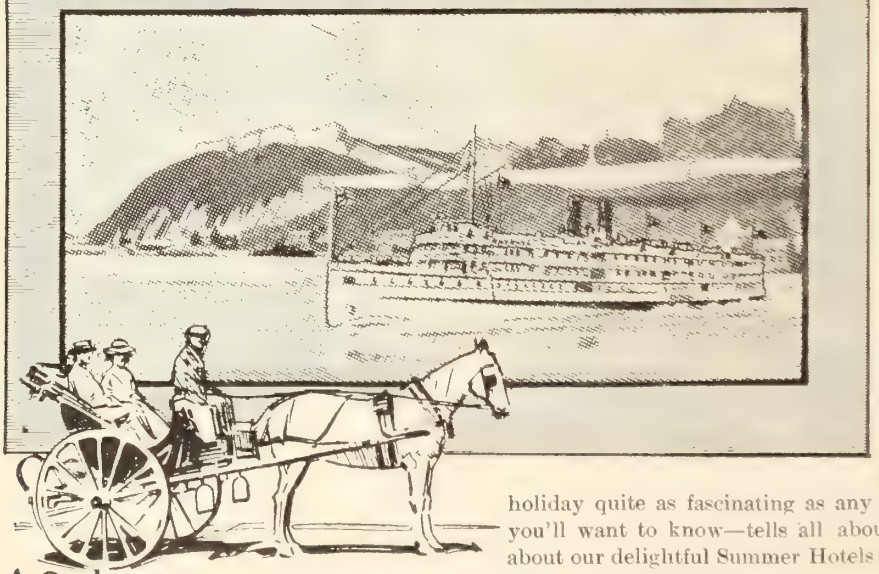

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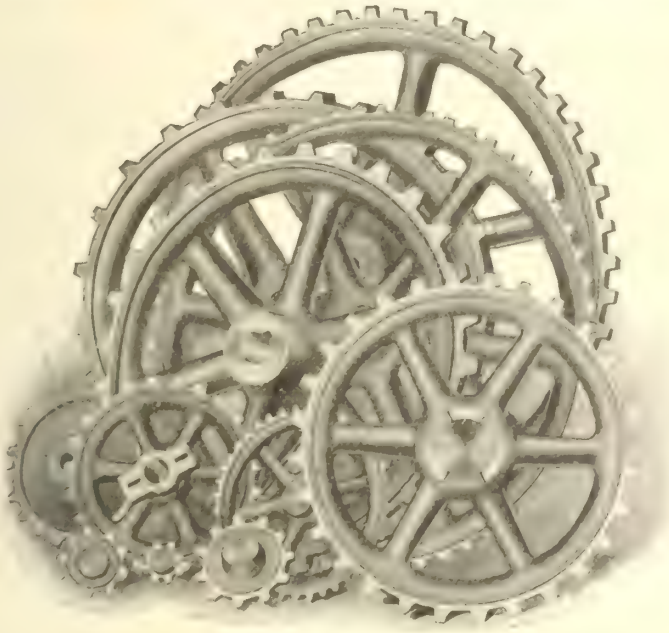

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Synopsis of Coal Mining Regulations

COAL mining rights of the Dominion, in Manitoba, Saskatchewan and Alberta, the Yukon Territory, the North-West Territories and in a portion of the Province of British Columbia, may be leased for a term of twenty-one years at an annual rental of $1 an acre. Not more than 2,560 acres will be leased to one applicant.

Application for a lease must be made by the applicant in person to the Agent or Sub-Agent of the district in which the rights applied for are situated.

In surveyed territory the land must be described by sections, or legal sub-divisions of sections, and in unsurveyed territory the tract applied for shall be staked out by the applicant himself.

Each application must be accompanied by a fee of $5 which will be refunded if the rights applied for are not available, but not otherwise. A royalty shall be paid on the merchantable output of the mine at the rate of five cents per ton.

The person operating the mine shall furnish the Agent with sworn returns accounting for the full quantity of merchantable coal mined and pay the royalty thereon. If the coal mining rights are not being operated, such returns should be furnished at least once a year.

The lease will include the coal mining rights only, but the lessee may be permitted to purchase whatever available surface rights may be considered necessary for the working of the mine at the rate of $10.00 an acre.

For full information application should be made to the Secretary of the Department of the Interior, Ottawa, or to any Agent or Sub-Agent of Dominion Lands.

W. W. CORY, Deputy Minister of the Interior.

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The output of the mines and metallurgical works of Ontario for the year 1913 was valued at $53,232,311. Ontario has the largest mineral production of any of the Provinces.

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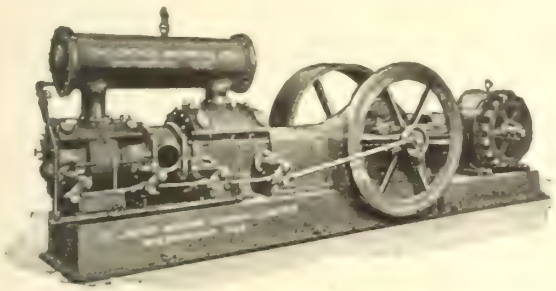

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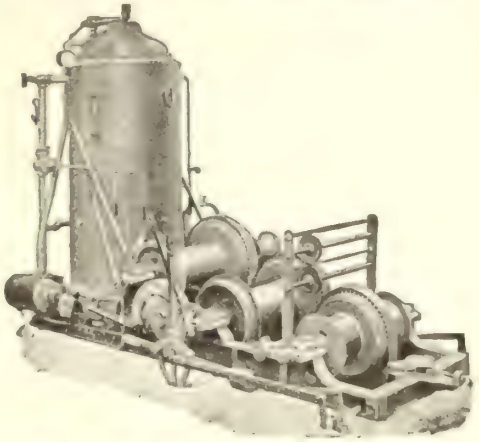

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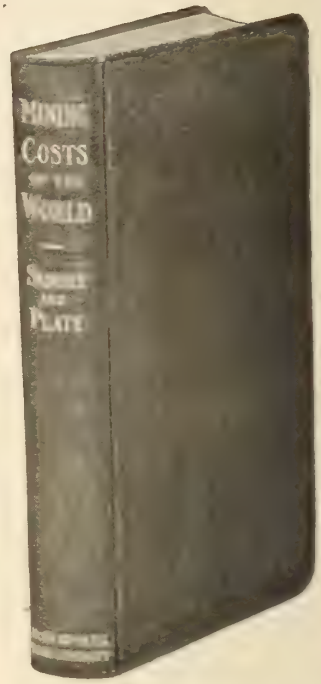

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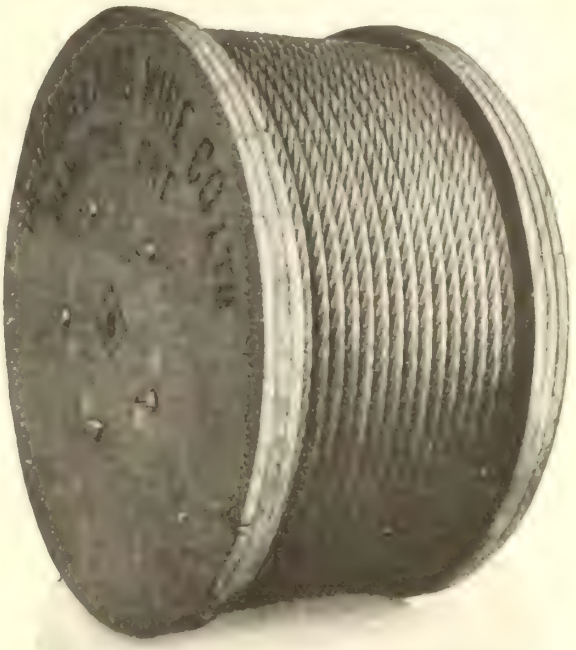

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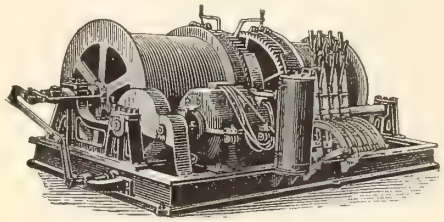

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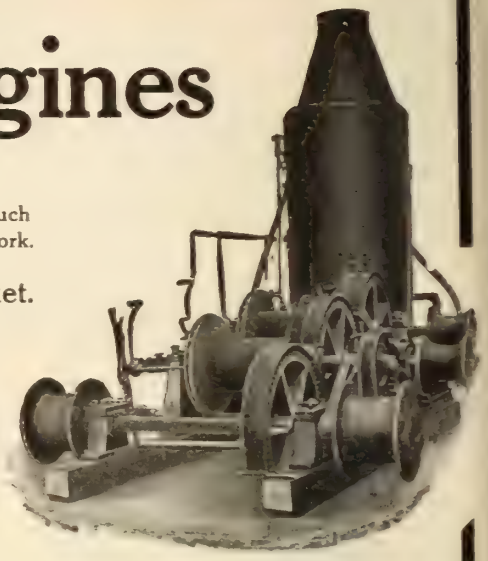

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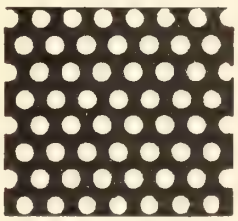

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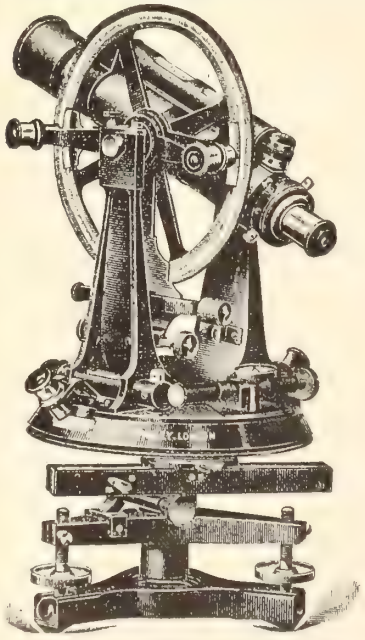

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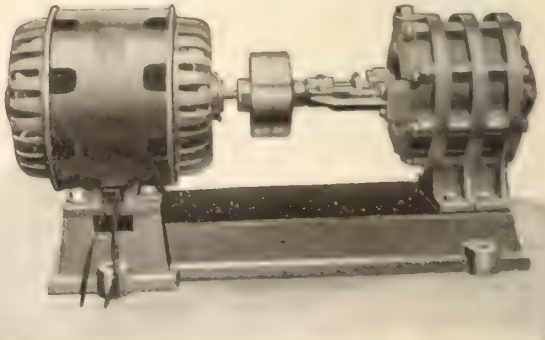

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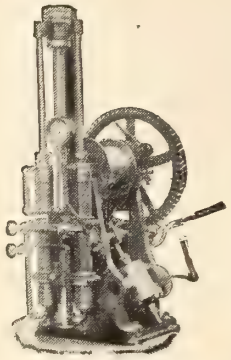

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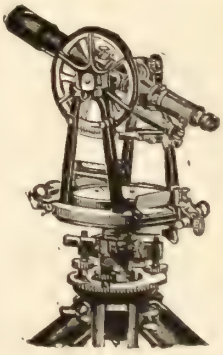

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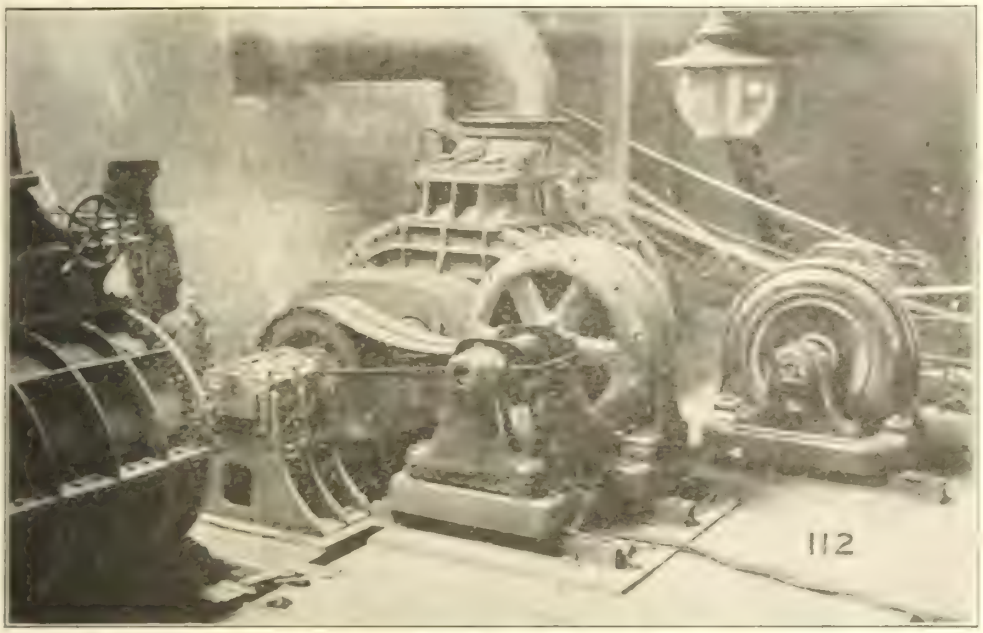

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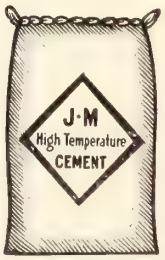

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THE CANADIAN MINING JOURNAL

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REGINALD E. HORE

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CIRCULATION

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INCREASE PRODUCTION

The world's resources are being used up at an unprecedented rate. The nations at war are piling up enormous debts. What are we doing in this country to keep our credit good? What are we doing to assist the Empire?

We have sent several thousands of our most worthy sons to the front and they have fought so valiantly that we have reason to be proud of them. What Canadian could read Sir John French's report of the battle of St. Julien without a thrill of satisfaction? In recounting the part played by the Canadian contingent he said: "The left flank of the Canadian division was thus left dangerously exposed to serious attack in the flank, and there appeared a prospect of their being overwhelmed and of a successful attempt by the Germans to cut off the British troops occupying the salient to the east. In spite of the danger to which they were exposed the Canadians held the ground with a magnificent display of tenacity and courage, and it is not too much to say that the bearing and conduct of these splendid troops averted a disaster which might have been attended with most serious consequences." Such words from so great a soldier in this stupendous war will ever live in the annals of Canadian military history.

There are thousands of young Canadians who would willingly make any sacrifice to render such service as did the men of the First Canadian Contingent at St. Julien. They need but to be instructed as to the seriousness of the situation. Mining men are taking a big part in the war and more of them may be expected to participate now that a better realization of the power of the enemy is permitted. Long preparation and masterly organization has enabled the Germans to perfect a fighting force that would be magnificent were it under humane control. In the hands of men more savage than the savages the German army is extremely dangerous. Mining men must be prepared to give serious consideration to the calls for recruits.

In supplying munitions Canada has also played no mean part. It is true that we might have supplied vastly larger amounts; but the evidence seems to indicate that the Canadian manufacturers were ready to handle large orders if they could have obtained them. It is to be hoped that the difficulties of the past will not be further accentuated, but that every effort will be made to increase the output.

The production of munitions has resulted in a much increased demand for several mine products. This is a particularly pleasing feature of the situation in that it makes both possible and profitable an increase in production of metals. This is very much to be desired, for it will help to preserve the country's credit, while it is

at the same time giving unusual profits to the producers.

An interesting article on the advantages to be gained by increasing production at this time was published editorially in the "Mail and Empire," Toronto, July 10, in part, the editorial follows:

"It may on first sight seem that enlarged, and still more enlarged, production on the part of this country is not of vital consequence to the success of British arms. It may be contended that, even if Canada produced no surplus of foodstuffs for exportation, Britain would be able to obtain all she requires from the United States and other neutral nations. But it is the duty of the farmers of Canada to do all they can to make Britain independent of foreign sources of supply. The question of making the Empire as nearly as possible self-reliant in the matter of food supply is one that has long engaged the thoughts of the largest minds concerned with the study of Imperial defence and Imperial organization generally. Apart from Imperial patriotism, national patriotism makes it the bounden duty of all who are occupied in the natural industries to employ their capital and their labor to the best economic advantage for increasing the output of those industries. Thereby they not only add to the wealth and prosperity of their country and increase the war supplies available within the Empire for the Empire's forces in the field, but also they assist to keep the trade between British and neutral countries on an even keel. The trade balance as between Britain and the United States has listed tremendously to the side of the latter country—nearly as much, indeed, as nine months ago it listed to the British side. As between Canada and the United States, the balance has greatly increased in recent years in favor of our neighbor. We must do more producing and less importing. In this war time Britain is not sending out merchandise on anything like the scale of her exports in normal times. The vast energies she applied to trade are now being largely concentrated in war and on war account. Nor are the efforts of her own workers yet sufficient for the production of war supplies that are produced in manufacturing plants. Her exports having shrunken greatly and her imports having still more greatly expanded, the external trade account keeps going heavily against her, and is likely to continue to do so for some time to come. Even as between this country and the Mother Country the visible balance of trade is far more heavily in our favor than ever. At the same time, the invisible balance is not being changed in Britain's favor as in years of peace, for the reason that British capital is being husbanded on war account, and the flow of it to this country has almost ceased.

"The situation presents its opportunities as well as its duties to all Canadians who have a will to produce. Our farmers ought to till every acre and bring out its fullest yield. They ought to widen their labor market so as to afford the amplest demand for the service of all city and town workers who can turn their hands to agricultural production. The present time is one that offers new inducements to enterprising men for the originating of production in other fields of natural industry. Prospectors ought to return to the wilds and explore the mineralized areas. Every commodity we can add to the list of home products should now be added. Existing gold mines that can be profitably worked ought to be fully manned and operated, and gold mines that are still hidden should be brought to light. The precious metal is now needed as it was never needed before. It would be a highly fortunate development were Canada suddenly enabled to quadruple the output of its gold mines, and by this means help to wipe out the adverse trade balance. All metals are needed by the Allies. As this country has almost unlimited natural resources of this description, the demand should be very much to our present advantage and permanent benefit."

It is, of course, a difficult time to raise money for any enterprise, but for those who are willing to take a mining chance the present time offers many incentives. Silver is at present selling at the lowest price since the Cobalt deposits were discovered, but other metals are selling at unusually high prices, and many metal mining companies are exceedingly prosperous.

PERSISTENCE OF ORE IN DEPTH

In a contribution to the discussion of a paper presented by Mr. T. A. Rickard before the Institution of Mining and Metallurgy, Mr. P. A. Robbins enters a plea for the recording of observations. He says: "When a man dies, the cause is known only to the engineers attending the case, and usually no attempt is made to add to the general store of information."

The question of persistence of values with depth is obviously an important one. The more closely an estimate approximates to the size and character of an orebody, the more economically can the ore be mined. The estimate decreases in value as the ore is worked out. It is most useful when operations are just to be commenced. It is least useful when the ore has all been removed. But, as Mr. Robbins points out, the information gained may become valuable if it is recorded. Especially is this so of similar deposits on neighboring properties. Useful less directly are data gathered from all sorts of ore deposits in all parts of the world.

In mining, as in other industries, information is contributed very freely by some operators and very closely held by others. As a rule the successful companies give out more information than do the unfortunate; but even among the most successful are some companies whose directors carefully guard against giving out real information concerning the nature of the ore reserves and their probable extent. Naturally, therefore, broad discussions of the question of persistence of ore in depth are at best based on data gathered from a few mines. Some venture to theorize without even searching the literature for the known facts, and in many cases the conclusions deduced are unwarranted. Mr. Robbins advocates the compilation of the evidence.

Theories are useful insofar as they enable us to understand and correlate facts and permit the making of predictions regarding the unknown. Hence, the value of assembling the facts depends upon the success in interpreting them. But we must have the data before we can expect anyone to act as interpreter.

BITUMINOUS SANDS OF ALBERTA

A writer in a recent issue of "Canada" in an article entitled "The Riches of the North-West," makes some remarkable statements about the bituminous sands of the Athabasca. That there are enormous deposits there has long been known and recent investigations carried on by Mr. S. V. Ells, of the Mines Branch, lead to the hope that some of the sands may be utilized for paving purposes. At present an experimental pavement is being laid at Edmonton. Under the circumstances it is strange to find a writer who claims to have intimate knowledge of his subject stating, as he does in "Canada," that "no doubt exists that, when this part of Alberta is opened by rail, it will supply all the requirements of mankind in bitumen for many centuries to come." Such extravagant statements do no good.

The superintendent of the Morro Velho mine proposes to use a refrigerating plant to cool the air sent into the lower levels of the mine. An interesting account of investigations carried on in this deep mine to solve the problem of working at great depths has been given by the superintendent and will be published in our next issue.

In connection with the discussion of persistence of ore in depth the recenty issued report on the Morro Velho mine, the deepest in the world, has some valuable information. According to the report "the lode has so far shown no signs of failure in size or ratio to the lowest explorations yet made upon it."

The development of the Hollinger and Acme mines is likely soon to result in an increase in milling facilities being made. At present ore from both properties is being treated in a 100-stamp mill.

The demand for nickel and copper has resulted in another mine being opened in the Sudbury district. Mr. J. A. Holmes and associates are operating a small property and selling ore to the Mond Nickel Company. This is the first time for years that anyone in the Sudbury district has attempted to compete with the big companies.

At a meeting of the Porcupine branch of the Canadian Mining Institute, Mr. D. Dorland, superintendent of the McIntyre mill, described some experiments which indicate that in the precipitating process much more zinc dust is generally used than is necessary. In view of the present price of zinc dust, operators of cyanide plants will be pleased to hear more about these experiments.

U. S. LEAD AND ZINC MINES SHOW INCREASING ACTIVITY.

"The high price of spelter that has obtained almost continuously since the European war began, has greatly stimulated the mining and smelting of zinc ore in the United States. The recent rise in the price of lead has given a double impetus to mining in those regions, such as the Joplin district, where the zinc ores are associated with lead ores." This is the introductory statement in the mid-year review of the lead and zinc situation, by C. E. Siebenthal, of the United States Geological Survey.

The present smelting capacity is scarcely equal to the demands upon it. This renders it imperative that as much spelter as possible be produced per retort, and puts a premium upon high-grade ores. The Joplin district blende averages about 58 % zinc content, though a considerable quantity of the concentrates averages 60 per cent. and higher and contains very little iron or lead; that of Eastern Tennessee averages over 60 per cent., and Butte, Mont., 55 per cent.; Wisconsin district blende averages 55 to 60 per cent. after roasting and magnetic treatment to remove the iron. High-grade calamine ores are also in demand, and an increased yield is being made from Arkansas and Missouri; also, lead-free New Jersey ores are in demand.

The spelter required for the manufacture of munitions of war must be of good quality, suitable for making sheet zinc and brass, and particularly of the highest grade for brass cartridge shells. This puts a further premium on the higher grade, purer zinc ores. To meet the demand for such metal, some smelters are redistilling their output to bring it up to a high standard, and are thus able to use a lower grade of ore. Such a method reduces the output of the plant by one-half, however, and adds greatly to the cost of the product.

The lack of smelting capacity has resulted in starting up old coal-fired plants in Missouri and Kansas that had been out of commission for years. All smelters are being rushed to their maximum capacity and additions to capacity are being rushed to completion.

The high-grade zinc ores of the Joplin regions are in greatest demand, and the district is teeming with activity. Churn drills are prospecting on every hand. Innumerable new shafts are being sunk, and old ones reopened. Old diggings are being unwatered, for ground too lean to work at previous prices can now be operated at a profit. The drilling campaign that has been proceeding north of the Miami, Okla., district for more than a year has resulted in many rich strikes and a number of concentrating plants are being built. This region is just now the most active part of the Joplin district.

Demand for lead during the early part of 1915 was not sufficient to increase prices materially, but in March the price per pound averaged about 4 cents for the first time since February, 1914. In April and May the advance continued, and during June there was a marked increase past 5 cents and well beyond 6 cents per lb. The lead-zinc and silver-lead mines still of course benefit by return to favorable prices for lead, and this market seems to respond to the general revival has given another favorable impetus into the metal mining situation at the half year mid. The lead production had probably been above normal demands for it in 1914 however, and amount of surplus stocks is not known

NEW MINE TELEPHONE.

A new mine telephone has recently been developed and is being placed on the market by L. T. Weiss, of New York City, N.Y.

The phone is a result of experimental work covering two years' time. It is the invention of A. A. Weiss, a telephone engineer.

A serious study of conditions and the means of best meeting them was undertaken. It developed that the troubles in the generally accepted mine telephone were due to rapid battery deterioration, grounding of the battery, breaking of parts, corrosion of small wires, corrosion of transmitter diaphragm, breaking down of induction coils, etc.

Another trouble was the fact that the average mine electrician is not very familiar with telephones and is generally equipped with large plyers, screw drivers, etc., and his efforts at repairs are comparable to those of the proverbial bull in a china shop.

It became evident that the magneto mine phone, from its necessarily complicated nature, was not capable of meeting mine conditions. The mine phone was merely an old bridging type magneto phone enclosed in a heavy iron case, with an outer and inner door, the bell, generator, battery, hook switch, transmitter, induction coil, and wiring being behind the inner door, the hook, receiver, receiver cord, generator handle, transmitter mouth piece, being exposed when the outer door was open. This outer door generally closed against a rubber gasket and had some form of ice box lock. As a matter of fact the outer door was never closed, in a great many cases being held open by hooks and nails so it could not be shut. An attempt made to avoid this condition resulted in some doors being broken off entirely. Miners are hardly noted for gentleness.

After continued study a central energy system and phone were considered and the present circuit and phone worked out.

This phone consists of a heavy iron case enclosing a receiver, a transmitter and two push buttons, all mounted so as to be unbreakable, the wiring is of heavy wire and is of the simplest character, anyone familiar with an electric bell and push button circuit can understand the new circuit. The waterproof bell is placed on the phone or wherever most desirable. A small bell or a load ringing bell can be used interchangeably. The central station consists of a simple relay and battery a trifle larger than battery equipment used for one of the old phones, also some form of ringing current which may be of any character most suitable to local conditions.

The central relay and battery are located in a suitable place on the surface. The whole system can be quickly installed on the old wiring without change.

The phone itself consists, in outward appearance, of an iron box with an opening to speak into, an armored rubber hose for listening purposes and the two buttons. No cord, wiring or instrument is visible. The transmitter and receiver and wiring are permanently locked up. The transmitter is connected to the speaking opening by a connection also in the box which prevents any moisture, expectoration, or mechanical injury to the diaphragm. The only damage that can be done is the removal of the armored rubber listening tube. Even this would not put the phone out of service and anyone could readily slip the hose or another one in place, or could listen at the hole over which the tube was placed.

It is a phone reduced absolutely to its lowest terms and has been in actual operation in several mines for over a year with satisfactory results. All the small mechanical difficulties inherent in new apparatus have been removed gradually as actual conditions demonstrated the necessity, until to-day it is absolutely foolproof and will meet any possible condition. It is the result of telephone engineering becoming familiar by actual experience with mining conditions.

It should also be noted that the phone is a lockout system, in other words two parties speaking are assured of privacy. This is a feature which will appeal to the mine officials and is not a part of the ordinary mine phone. It often becomes necessary for a mine captain to defer a conversation with a shift boss on account of the lack of this feature.

U. S. PRODUCTION OF EXPLOSIVES.

The total production of explosives in the United States during the year 1914, exclusive of exports, according to figures compiled by Albert H .Fay, of the United States Bureau of Mines, was 450,251,489 lb., or 225,126 short tons, as compared with 500,015,845 lb., or 250,008 short tons for 1913. The production for 1914 is segregated as follows: Black powder, 206,099,700 lb.; "high" explosives other than permissible explosives, 218,453,971 lb., and permissible explosives, 25,697,818 lb.

The figures represent a decrease of 23,839,831 lb. of black powder, 23,932,573 lb. of high explosives, and 1,987,952 lb. of permissible explosives, as compared with 1913.

Mr. Fay says: "As explosives are essential to mining, and the use of improved types of explosives tends to lessen the dangers attending this industry, the Bureau of Mines undertook the compilation of information showing the total amount of explosives manufactured and used in the United States, its first report dealing with the year 1912. The report for 1914 is therefore the third technical paper issued by the bureau relating to the production and distribution of explosives.

"In the year 1902 only 11,300 lb. of permissible explosives were used in coal mining, whereas in 1913 the quantity so used was 21,804,285 lb., as compared with 19,593,892 lb. in 1914. The quantity of permissible explosives used in the United States is larger than in a number of foreign countries. In 1912, it represented about 5 per cent .of the total quantity of explosives produced, and in 1914, 5.7 per cent. The total amount of explosives used for the production of coal in 1914 was 220,622,487 lb., of which about 8.9 per cent. was of the permissible class, as compared with 9.5 per cent. in 1913."

MORE CALIFORNIA GOLD IN 1915.

There are few changes in the mining industry in California for the first six months of the year, as compared with the conditions in 1914. Mr. Charles G. Yale, of the United States Geological Survey, reports that some gain in gold yield is apparent, however, the United States Mint at San Francisco, and local smelters and refiners, having received $508,822 more California gold in the first five months of 1915, than in the corresponding period of 1914.

The German's Prayer.

She: "One of the most touching things about the war is the way France became religious. All the Frenchmen pray."

He: "Und all der Chermans Bray, too! Dey Bray gott damn England!"—Life.

LOVE'S LABOR LOST—THE ORIGIN OF NATURAL GAS AND PETROLEUM

Almost ever since its first appearance above the horizon, even while its present secretary was still basking amid the roses and the sunshine of Vancouver's western isle, and long before his pilgrimage to Mount Royal's frowning front, the Canadian Mining Institute, at many of its annual meetings, made a specialty of discussions on the Volcanic or Inorganic Origin of Natural Gas and Petroleum. The result of these discussions was that the organic hypothesis seemed to most of us to have passed into oblivion along with theories of the flat earth and innumerable other pre- and post-Columbian myths.

That, in the earlier years of these discussions, some of the members of the Institute were unconvinced, and inclined to be at least facetious when contributing to the debate, is shown by the awful conundrum that Mr. G. R. Mickle propounded to the shocked gathering of 1903. He asked: "What is the difference between a vegetarian and a man who believes in the organic origin of natural gas and petroleum?" No answer was attempted by the bewildered audience, a profound silence ensuing until finally the questioner himself replied: "The former draws the line at meat, while the latter will swallow anything!"

But, in spite of such digressions from seriousness, discussions continued until scarcely a man in the Institute attempted to attack the volcanic hypothesis. Through cold logic, and probably in some cases partly through compulsion, the members accepted the Costean theory. Even Mr. Mickle has long since come to be looked upon as a defender of the faith (vide his recent illuminating paper entitled, "The Chemical Composition of Natural Gas"). To many of us, however, the acceptance of the inorganic hypothesis meant a long struggle accompanied by much mental anguish. We had been nurtured from early youth on the organic theory. There was something in this theory that appealed to our boyish imaginations, although from the economic point of view it might not appear adequate to account for the vast supplies of gas and oil stored in the rocks. In youthful fancy we ran over the limitless hosts of mammals, marsupials, birds, reptiles and fishes, not to say invertebrates and plants, that have appeared in never-ending succession, generation after generation, since earth's early dawn. We pictured these creatures passing from youth to old age, then being entombed and turned into, as the text-books say, "those materials, natural gas and oil, most useful to man." When we carried the family coal oil can from the country grocery or read Bellamy Brinkmanship beside the parental hearth under a lamp or a gas jet, we often pondered on the source of the lighting and heating material. Had it once been a constituent of the body of a mammoth or of that of a gigantic plate-covered fish or of one of those terrible flying reptiles of the Mesozoic? Byron's line, "The last we tread upon was once alive," often recurred to us. It was indeed a wrench to forsake the organic theory for the volcanic. No Latimer or Knox, or Newman, or Manning, ever went through a severer mental searching when seeking the light regarding the fundamental concepts of theology that did those of us who gave up the organic for the Costean articles of faith.

And now in our old age must we give up our dearly cherished hypothesis, adopted after long years of mental struggle? Must we again set sail on the troubled waters of uncertainty, as of yore Aeneas, after all he held sacred had been destroyed, left ravaged Troy for beckoning Latium? It would appear that such must be our fate—judging from the following extract from the recently published report, "Petroleum and Natural Gas Resources of Canada," No. 291, page 70, of the Dominion Mines Branch, Ottawa:

"This feeling has grown so strong that seldom was any explanation of the origin of petroleum put forward, except the organic theory, until 1903, when an ardent advocate of the inorganic theory, Eugene Coste, appeared upon the scene and presented a fairly able defence of the theory. He claimed to have applied the principles of this theory in the practical development of several oil and gas fields, and he expressed full confidence that it applied to all occurrences of such hydrocarbons. Mr. Coste presented no new evidence and consequently made no addition to existing knowledge. He attempted to explain every phenomenon connected with an oil field by volcanic or solfataric action, but unfortunately most of his evidence was derived from the reports of others and he was apparently deceived by the term mud volcanoes, thinking them phenomena of true vulcanism."

It is cruel to tell us that our champion "made no addition to existing knowledge." It is thrice cruel, however, to say that our vulcanist, in all his applications of the volcanic theory, was merely mistaking the activities of "mud" volcanoes for the phenomena of true vulcanism. Must the volcanic theory disciples now be classed as "mud geologists" along with the flat men?

The use of the term "mud" at one annual meeting of the Institute nearly led to a riot. There had been some discussion as to certain dredging or other operations which had not been a great success, financially or otherwise, when our first secretary said in sweet Scottish tones, to the man who had been chiefly concerned in the operations: "A Moses went through rock and struck water. You went through water and struck mud, and now your name is 'Mud.'" Let us hope that no animosities will be engendered by the accusation that the pseudo-volcanoes of mud have been mistaken for the real.

We can picture to ourselves the state of mind of the author of the volcanic theory as, after perusing the Mines Branch report, he gazes in rueful meditation on the Rockies' lonely, snow-capped peaks from Calgary's distant towers. No sadder reflections must have marked that other great leader of the race as he looked from Elba's prison strand towards France's ungrateful shores.

One leader's use of a striking simile in a memorable debate a few years ago seemed to us to shatter all belief in the origin of oil and gas from the larger organisms at least. His statement ran to the effect it would be as reasonable to expect to obtain oil and gas by putting a turkey in cold storage for a hundred years or other long period, as to have it produced by the burial of organisms under normal conditions of heat and pressure.

During late years the "organics" seem to have narrowed the field of application of their theory until we find them claiming that gas and oil in some great areas at least have come from the distillation of the remains of microscopic organisms that lie on the bot-

der land between the animal kingdom and that of the vegetable. This last defence would also probably have been shattered ere this, had we called to our assistance the members of that new science known as Biochemistry. But the science is so new that, in so far as I recall, the name has never before appeared on the pages of the Journal, even in the days of the first editor with his adjectival fecundity. The controversy between the organic and inorganic adherents has not as yet been entered by biochemists. But in the future, if the discussion is continued, they are destined to play a leading part on the side of the vulcanists. Let us call them in at once and save the situation.

The following quotations from papers by two of these brethren show how strongly the men whose business it is to deal with the very beginnings of life, or "spontaneous generation," support the volcanic theory:

(1) "The question which we now must face is this: Did conditions ever exist in the history of the globe which favored the production by natural means of such ultra-microscopic organisms? The answer which I would make to this question is an affirmative one.

"There must have been present also in the atmosphere hydrocarbons of all kinds for the action of water on the hot rock crust must have formed them from the metallic carbides, such as carbide of iron and of calcium, as probably happens to-day also in the production of petroleum compounds in connection with hot subterranean rocks.

"This formation of amino acids and their synthesis to form proteins would take place countless millions of times and in every variety of constitution until one giving the right composition resulted in ultramicroscopic particles which, endowed with the chemical properties of ultramicroscopic organisms, would thrive and reproduce themselves in water which contained amino-acids and would thus supply readily assimilable food to the newly-formed living structures."

(2) "The protamic nucleus may be taken to represent the first form in which self-generating matter might be said to have the characters of protoplasm, but previously to its synthesis there must have occurred an increasingly complex series of carbon compounds, with hydrogen, oxygen, nitrogen, sulphur and phosphorus, while iron, calcium, magnesium and potassium are also involved in its activities at the present time . . . . . the possible interactions and combinations might result in the synthesis of very complex substances, well up toward the simpler forms of living matters."—M.

BRITISH COLUMBIA'S EXHIBIT AT THE PANAMA-PACIFIC.

It will be remembered that in 1909 the Canadian Government exhibition pavilion at the Alaska-Yukon-Pacific Exposition was a decidedly creditable one and that the display made there of Canadian scenes, fauna and resources, especially in respect of the last-mentioned, was one that Canadians had good reason to be proud of. There is little doubt, though, that the Canadian exhibit, now being made at San Francisco is far and away ahead of that made at Seattle, and that it is widely representative of the Dominion as a whole. The knowledge that this might be expected to be the case led the Government of British Columbia to take full advantage of this exceptional opportunity to give publicity to the resources of this Province, especially as a fine display, in particular of its fruit and minerals, was to be included in the Dominion exhibit. Prominent in this work of directing widespread attention to the products of the Province was the British Columbia Department of Mines, which has already sent to San Francisco for gratuitous distribution about 16,000 printed pamphlets, including the following mining bulletins: No. 1, "Preliminary Review and Estimate of Mineral Production, 1914"; No. 2, "Atlin Mining Division"; No. 3, "Skeena Mining Division"; No. 4, "Omineca Mining Division."

On June 18 there was issued from the Provincial Government Printing Office, Victoria, B.C., also for distribution at San Francisco, a useful publication, a pamphlet of about forty pages, entitled "British Columbia, the Mineral Province of Canada," got up in attractive form and well illustrated. This pamphlet contains a short history of mining in the Province, a synopsis of the mining laws in force, statistics of mineral production to date, and a brief summary of the progress of mining in British Columbia during 1914. The statistical information presents in a convenient and telling way the main facts of mineral production and the comments on the chief minerals produced last year are instructive and calculated favorably to impress readers with the great value and extent of the mineral resources of the Province.

TIN, TUNGSTEN, AND MOLYBDENUM.

Three of the minor metals present interesting phases in the mineral situation, and are discussed by F. L. Hess in a United States Geological Survey mid-year review. Although the United States consumes about 40 per cent. of the world's tin output, it produces an insignificant quantity and smelts practically none. On the other hand, Great Britain controls about three-fourths of the tin output of the world and a somewhat larger percentage of the smelted tin. On account of the war Great Britain has placed restrictions on the export of tin which have given American manufacturers trouble in getting needed supplies. Therefore, many schemes have been launched for building and operating tin smelters in the United States.

The Bolivian ore, which has hitherto been shipped to Europe for reduction has comprised the largest quantity of ore free from British governmental domination and towards securing this ore efforts have been directed. It will be remembered that a few years ago a tin smelter to operate on ore from the Malay Peninsula was erected at Bayonne, N.J., but the British Government placed a heavy export duty on tin ores, and the smelter was converted to other purposes.

Early in June it was announced that a tin smelter, to have a capacity of 3,000 to 5,000 tons a year, was being built at Perth Amboy, by the American Smelting and Refining Company. The smelter is to operate on Bolivian ores, but will undoubtedly also be in the market for other ores which may be offered, such as the lots which are mined in Alaska and occasionally at other places in the United States.

At the outbreak of the European war the American tungsten market was very dull and prices were comparatively low, about $6.50 a unit (one per cent. of a short ton). The ores mined in Burma, Australia, and other countries, came into competition with the American ores and many of the prospects were unworked. There is a normal demand for tungsten to be used in "high speed" tool-steels, which fluctuates with the steel trade, and a smaller but growing demand for tungsten for incandescent electric lamp filaments, for electric contacts, wire for dental work, etc., but when the orders for shrapnel shells and other war steel began to be filled the demand for high speed steel for tools with which to turn and bore the shells became very great.

PERSISTENCE OF ORE IN DEPTH*

By P. A. Robbins.

The importance of the question of persistence of ore in depth is attested to by the already lengthy discussion which has taken place on Mr. Rickard's paper. The profit of the discussion to the membership as a whole may be approximately measured by the value of the original paper, for throughout the discussion there have been but few new specific data submitted.

The paper of Dr. Malcolm Maclaren has been referred to in the discussion, and, in fact, this paper, together with that of Mr. Rickard, may be taken as the basis of the entire discussion.

Taking a broad survey of the whole question, the lessons seem to be: Mr. Rickard teaches that "Ores usually do not, but sometimes do, persist to the limit of 5,000 ft.; therefore, be cautious in going to depth, but bolder in widening the search at shallower horizons." Dr. Maclaren teaches that "Ores usually do not, but sometimes do, persist to the limit of 5,000 ft.; therefore, do not be discouraged (if conditions are favorable) from continuing somewhat further in depth beyond the seeming limit of ore, and do not neglect the possibility of locating parallel orebodies which may be the means of continuing operations to greater depths."

Twenty-seven years ago, after a general discussion upon the extent and formation of fissures, S. F. Emmons in a paper entitled "Structural Relations of Ore Deposits," said, "The practical lesson to be learned from the above phenomena is that the miner should not confine his explorations to a single fissure in which his ore occurs; but when he runs out of bonanza in that, he should seek a continuance of it in some adjoining fissure or plane, in a direction to be determined by the study of the system of the fracturing of the region and of the general direction of the bonanzas."

The lesson taught by Mr. Emmons would seem to lie between, or rather to embrace, both the views of Mr. Rickard and of Dr. Maclaren.

Mr. Rickard has presented facts and figures, having, as it were, measured his "positive ore." Dr. Maclaren draws attention to the "possible ore" which may exist, and we may deduce the "probable ore" from a consideration of the opinions of both authorities, receiving caution from Mr. Rickard and hope from Dr. Maclaren; being restrained upon the one hand from going too far, while on the other hand being encouraged to seek somewhat farther.

I do not read in the paper of Mr. Rickard any desire to belittle the actual potentialities of mining, but merely a desire to preach a policy of conservatism in dealing with a question of vital importance.

It is of interest to the profession that Mr. Rickard should record the deductions arrived at by him, and we appreciate the concrete examples presented by him in support of his deductions. To prepare, for presentation in debatable form, data concerning all of the orebodies which have come within the scope of his experience would be a task of very large dimensions, and to be ready to defend his proofs would necessitate the laying aside of all other business, hence our thanks are due to him for the very considerable amount of data submitted.

In the discussion which has taken place on which has been made upon basic facts presented; it is the author's deductions which have been challenged.

Unfortunately, in most cases the challengers have not supported their arguments with definite figures, but have resorted to a variety of platitudes and reasons with which to confront Mr. Rickard, even going so far as to present the argument that the author was wrong in his judgment, because mining promoters and brokers will not employ engineers (?) who agree with his views.

At the outset of Dr. Maclaren's paper, the author clearly defined the limits of depth by the statement: "In this review then depth is understood to be a zone extending downward from 500 ft. to 6,000 ft. below the earth's surface." His discussion is further limited to the "(presumably) primary ore." The qualifying of "primary ore" by "presumably" is a clear intimation that the author does not feel justified in accepting as finally correct the usual conception of the meaning of "primary ore."

Dr. Maclaren goes as far as possible in giving the results of his observations and deductions, presenting enough evidence to illustrate, but not attempting to substantiate, his reasoning. As in the case of Mr. Rickard, voluminous statistical proof is not necessary, it is sufficient to know what convictions have been the outcome of Dr. Maclaren's search after truth. He has had unusual opportunities for observation, and is by nature and training a scientist, not given to the expression of carelessly formed opinions.

The whole tenor of the discussion has brought out forcibly that the Institution of Mining and Metallurgy is a practical organization, as much interested in settling the "bread and butter question" as in following the subterranean delvings of fancy.

Mining men grade by imperceptible degrees, from the visionary, optimistic promoter, to the unseeing, unimaginative pessimist, and their angles of vision must be known before their opinions can be properly weighed. It is no wonder then that the untrained owner or mine director is often befogged by the diversity of opinion which he will find to exist upon seemingly simple questions.

Mr. Rickard's comments upon the lack of boldness of engineers in developing the properties under their charge, prompt me to draw attention to the fact that the determination as to whether or not "rock is ore," does not depend upon metal contents alone. There are many instances where rock has remained waste, until funds became available for boldly converting it into ore. The directors, shareholders, or other financial backers of a mining enterprise have far more to do with the amount of work that is generally considered to be done. The methods employed in development are not always indicative of the engineer's faith, more often than not he is limited in the amount of capital available and must lay out his work accordingly.

It requires years of training to produce a financier who has the courage to authorize the expenditure of such sums as those given by Mr. Holford in his recent paper. The Hammond-Rhodes episode is a classic in mining tradition. Mr. Hammond has received the rewards which his foresight deserved, and due credit should be given to Mr. Rhodes and others for the confidence with which they accepted geological deductions and made a bold advance in a problem which could have been but imperfectly understood by them.

*A contribution to the discussion of a paper by P. A. Robbins published as Bull. No. 102 by the Institution of Mining and Metallurgy, London.

It was their training and experience in large problems, their well developed breadth of vision, their belief in mining as an industry, and their faith in the professional miner, which caused them to attack the problem in a large way, and furnish the necessary funds for the work of proving the "persistence of ore to depth."

Experience is the great teacher, and the broader the opportunities for observation and study, the more exact and valuable will become the engineer's knowledge.

When a man or animal dies, the doctors hold a post-mortem examination; the symptoms of the illness are noted, and the findings of the final examinations are recorded. By carefully compiling the observations from thousands of cases, a basis for exact diagnosis in new cases is eventually arrived at.

When a mine dies, the cause is known only to the engineers attending the case, and usually no attempt is made to add to the general store of information.

Should we not follow the example set by the medical profession, laying bare the contents of the great graveyard of mining ventures, exhuming the remains, and by means of post mortems arriving at definite conclusions for our future guidance?

An opinon upon the persistence of any orebody to depth, is formed by combining visual physical properties, with geological deductions, combining theory with experience.

It would seem that there are possibilities for the formation of a new orebody in this contact zone between theory and practice. May not the ascending warm solutions from the regions of pure geology, mixing with the cooling vadose waters of experience, lead to the precipitation of a deposit of enormous value, which by scientific treatment may be reduced to a condition of comparative accuracy?

Many members have displayed a desire to contribute to a fuller knowledge of the subject which has been under discussion, and there can be no doubt that many others are equally willing and able to do so.

I propose that the contending forces lay down their arms and unite in gathering together the multitudinous scraps of information which must be available, and that instead of tearing up one another's exhibits, these be reduced to one comprehensive epitome of the subject.

Evidence submitted in a contentious spirit must be biased and of doubtful value, but the same evidence produced in a spirit of friendliness may be of great value.

The present time is propitious. The European war, the Mexican troubles and the general tightness of money have all helped to throw a large number of mining men out of employment. These men, collectively, possess a vast fund of information in the way of memory, notes and reports, which could be brought together for analysis, and in view of the general slackness, it would no doubt be a pleasure for many to occupy themselves with the working up of the information possessed by them.

The information so gathered would be of great value to members of the profession, and in fact, all connected with the mining industry, and as information which costs nothing is thought lightly of, I would propose that a fund be collected for the purpose of carrying on the work, and that all who will profit from the study of this important subject, be prevailed upon to contribute to the fund.

I would suggest that a salaried committee be appointed to direct the work, that salaried territorial agents be appointed in various parts of the world to cover the work in the territories, and that they in turn select suitable engineers for the research work.

At the present time, when such a number of men are available, many would no doubt be willing to devote their time to this work for a remuneration which in ordinary times they could not afford to accept; in a word, it appears to me a most excellent opportunity to inaugurate some profitable relief work.

Many members of the Institution are in positions where they can make clear to their employers and clients the value of the work to be undertaken, and there should be no difficulty in collecting funds for the purpose.

Individual effort has been made along the lines proposed, and it is the excellent work of Maclaren, Curle and others which encourages me in a belief that a united effort would produce striking results.

Might we not arrive at a mathematical solution of our problem? It is not inconceivable that, given sufficient data, we might learn how to arrange our various factors for differentiation between known or assumed limits, and obtain a derivative which would approximate closely the truth.

Of what value as indicators for good or bad are the various minerals encountered in gold quartz veins? In contacts between igneous rocks, what and where are the likely disposition of values? Such questions are to be answered, not by chemical-geological reasoning, but by the cold facts of accumulated evidence.

In discussions of questions relating to orebodies there is usually a line of cleavage between the geological scientist and the practical miner, a lack of appreciation by both parties of the merits of one another. Has the time not arrived when the experiences of all may be welded together to form a powerful tool in our equipment?

Twenty-seven years have elapsed between the messages of Emmons, and those of Mr. Rickard and Dr. Maclaren, and yet the messages are not greatly different. The evidence for more positive declarations is available, why not compile it?

I have before me a paper read by Prof. Geo. R. Mickle before the Cobalt branch of the Canadian Mining Institute in May, 1912, entitled "The Probable Total Production of Silver from the Cobalt District." It is a unique paper, applying mathematics to a study of the possibilities of the Cobalt field. In it, the author, by applying the method of least squares to his probable errors, arrives at figures for the probable production of the then known orebodies, and he further deduces the probable production of orebodies at that time undiscovered. To anyone acquainted with the vagaries of the Cobalt field, the prognostications seemed unwarrantably bold, and yet the indications are that Prof. Mickle was within reasonably correct bounds in his figures.

Given a larger scope for observations, and the more complete data of the entire field of mining, it would seem that a series of mathematical deductions might be made which would greatly enhance our present knowledge of the chances for the "Persistence of Ore to Depth."

The coroner's jury empanelled to enquire into the circumstances connected with the explosion at the Western Fuel Co.'s Reserve mine, Nanaimo, Vancouver Island, B.C., returned a verdict to the effect that the death of the twenty-two men who lost their lives in that disaster, was accidental, and added, that "after hearing the evidence of thirty three witnesses we cannot attach blame to any person. We also find that every precaution and care had been fully exercised by the management of the Western Fuel Company."

NOTES ON HOMESTAKE METALLURGY*

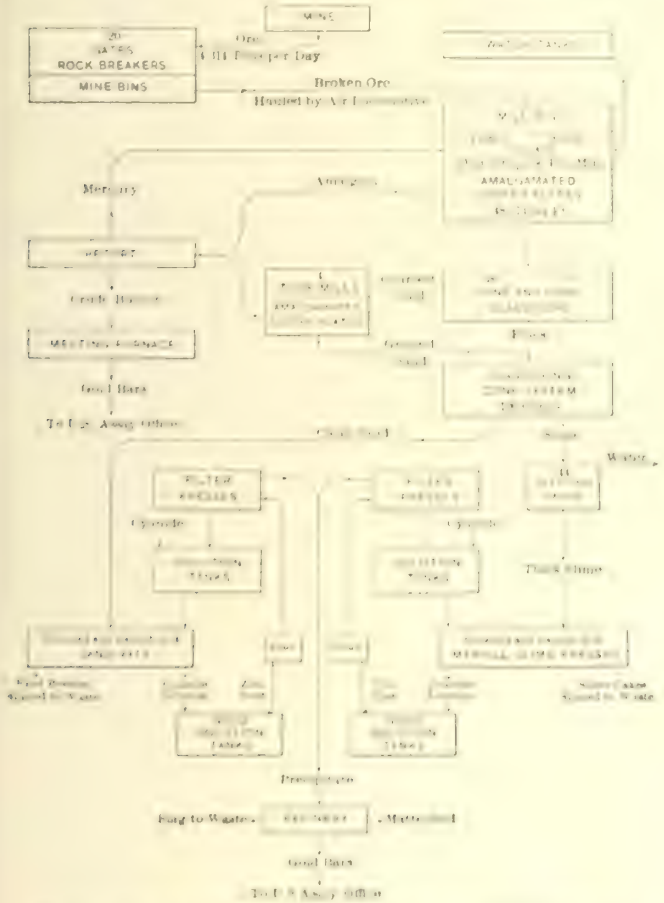
By Allan J. Clark

(Continued from last issue.)

Slime Treatment.

The slime plant is equipped with 30 Merrill presses, each of 90 frames, 4 ft. by 6 ft. by 4 in. One press holds 26 tons of slime, and has a capacity of about 70 tons a day.

The entire treatment is given in the presses, which successfully meet the conditions for which they were designed, holding a tight and homogeneous cake during aeration periods (which impose a most exacting requirement on the machines) and discharging readily, without requiring manual labor. In this connection it may be mentioned that all the operations incident to the filling, aerating, leaching, washing, and discharging of 30 presses—totaling about 75 charges daily—are



Flow sheet, showing ore treatment at Homestake mine

conducted by three men on each shift. The actual time required by one of these men in the performance of every step in the treatment of a charge is slightly less than 15 min.

Treatment is in principle identical with that of the sand, periods of aeration and treatment alternating with sufficient frequency to maintain the activity of the solutions. The alkalinity is carried at a very low point, and the working solutions are of low cyanide strength. Within the restrictions imposed by practice, there seems to be no solution so weak that it will not freely extract gold from the aerated slime. The problem seems to demand the passing of a definite volume of solution through the slime cake, rather than treating with solution of a definite strength or for a definite time. So long as this amount of solution is passed, the extraction is accomplished. Thus the treatment time is a function of the leaching rate.

The minimum working strength is determined by our ability to precipitate the effluent solution, and in developing this minimum much of the treatment is given with very dilute solutions, with the result that the consumption of cyanide has been reduced to an extremely low figure. For instance, a 10-day period, concluding as this is written, gives the following:

Sodium Cyanide (128 per cent.) consumed per ton of slime treated: In treatment, 0.127; added for precipitation, 0.008; total, 0.135.

The precipitation of the "low solution" (first and final effluents, low in both gold and cyanide) is difficult; doubly so on account of the low alkalinity; and after trial of many expedients to assist it we are not able to improve upon Carter's old system of a drip of strong solution.

This, usually added with the feed of zinc dust at the rate of 1 lb. per hour (or per 25 tons of solution precipitated) constitutes from 5 to 10 per cent. of the cyanide used. An excessive amount of zinc dust is also necessary to insure clean precipitation of these solutions, and this entails further expense, not merely in the first cost of zinc, but in the refining of the larger bulk of low-grade precipitate. Combined, these costs consume about 25 per cent. of the profit won through the reduction of cyanide consumption, a satisfactory enough result in a plant where treatment methods have been so well established as is the case here, even though the impression may be conveyed that one branch of the work has lost efficiency.

Some assistance in this precipitation difficulty is secured through the application of this barren low solution as a preliminary wash.

Double cloths are used on the treatment presses, the bottom one being in contact with the frame. This is of unbleached muslin twill, and is in turn covered with a cloth of No. 10 canvas duck. Joints are made with Thermalite paint.

During the early days of the plant, when the equipment was not equal in capacity to the tonnage of available slime, a suit of cloths was used for as much as 30 months, it being preferable to lose slime values than to stop to repair leaks. It should be remembered that the arrangement of ports and channels in the presses is such that treatment may be given in either direction, so that a single leak would in no wise affect treatment, but would merely entail the wasting from the slight of a certain amount of untreated slime. At this time, as much as 500 tons was wasted in a month. As the plant has been brought to full capacity, the cloths have been renewed first after 18 months' service, now after 16 months; the leakage loss on the latter basis has been brought to an average of less than 40 tons monthly over an entire year, with a minimum of 8 tons in a single month. This in treating a total monthly tonnage of more than 58,000.

The "flow gravity" system of tonnage measurements, elaborated by W. J. Sharwood (Mining Magazine, vol. i, No. 3, p. 226, Nov., 1909) finds an interesting application in the estimate of slime treated at this plant. Here, even were it possible to determine the weight of the slime taken, it would still be impos-

*Extracts from a paper to be read at the San Francisco Meeting, American Institute of Mining Engineers, September, 1915.

sible to know the tonnage treated, since the amount of slime retained in a press after sluicing cannot be absolutely known. Certain classes of slime are more difficultly discharged than others; the stoppage of a single sluicing nozzle leaves 1.1 per cent. of the press unsluiced. Frequent testing sluicing bars and examination of presses after sluicing protect us from loss of efficiency from this cause, so that the sluicing is never

A is filled, the time and volume are noted, the valve from B is closed, the pulp turned to tank B and the discharge valve from tank A is opened. These alternations continue throughout the period assigned for measuring. Changing, which is at intervals of about 35 min., is not instantaneous, but the actual measurements cover 90 per cent. of the total time, sufficient to insure a correct average rate.

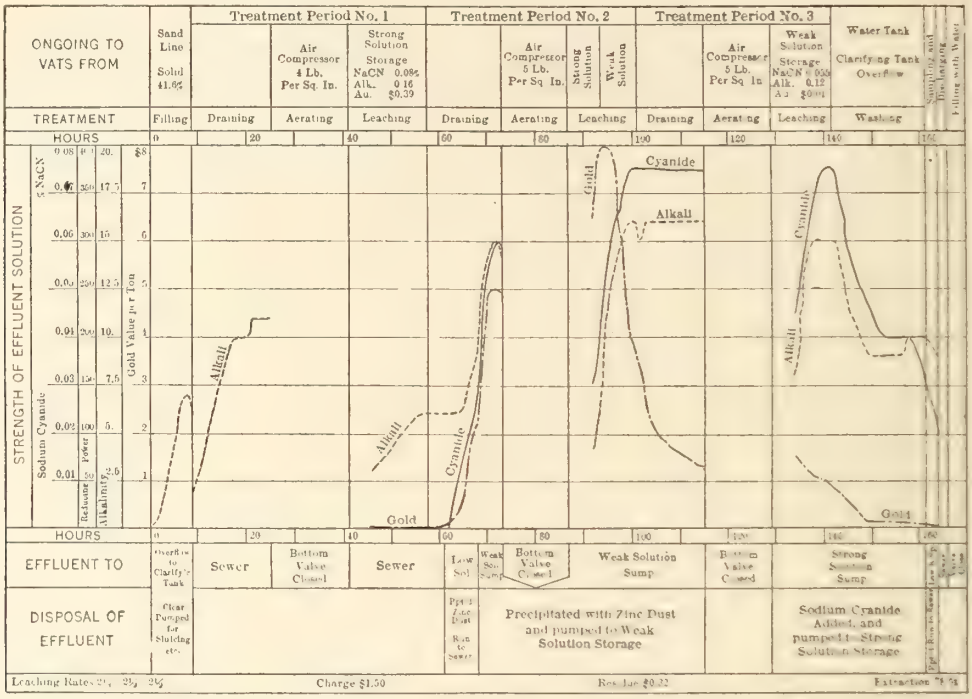
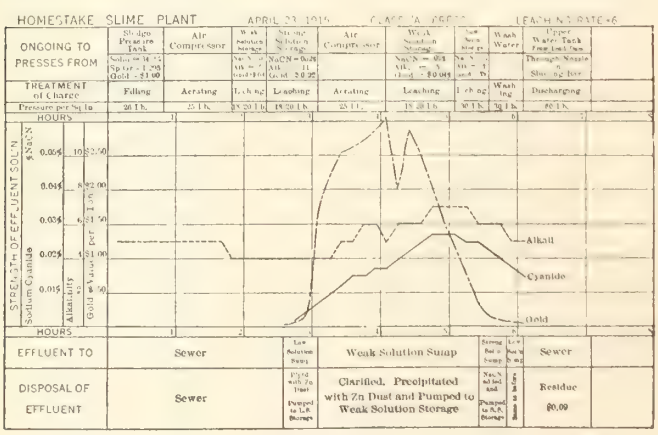


Chart showing treatment at Sand Plant No. 1. Data secured in March, 1914.

less than 96 per cent. efficient, and is at present, in my judgment, close to 99 per cent.

To at once determine the net capacity of a press, the "flow-gravity" system is used in a large way, measuring the total tonnage received at the plant during a 24-hr. period. This method is simple, thorough, and convincing, and since it is not so generally known as



Treatment of Fast-Leaching Charge at Homestake Slime Plant.

its value warrants, the full report of such a test is given herewith.

Procedure—Valves on the two "sludge tanks" receiving the incoming stream of pulp are closed. The depth of slime in each tank and the time are noted. The stream of pulp is now diverted to tank A, the discharge valve from which is closed, the presses being served with pulp delivered from tank B. When tank

At half-hourly intervals the stream of pulp is cut by a mechanical sampler, a 5-gal. bucket being filled and the weight of pulp determined. These determinations are averaged. A specific gravity determination is made on the average sample of slime.

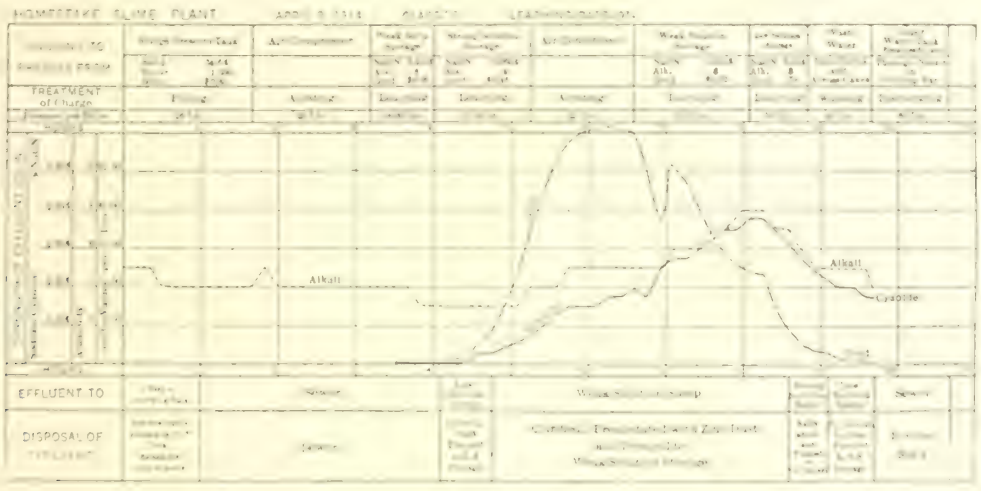
Estimate of tonnage treated between noon of April 8, 1915, and noon on following day:

	Feet.	Cu. Ft.
North Sludge Tank—		
Total depth pulp to tank	132.667	
Deduct, lime water	1.078	
Balance, slime pulp	131.589	
131.589 × 518.85 (cu. ft. per ft. of depth)		68,274.95
South Sludge Tank—		
Total depth pulp to tank . . .	125.334	
Deduct, lime water	1.003	
Balance, slime pulp	124.331	
124.331 × 514.42		63,958.35
Total cu. ft. for 22.05 measured hours.		132,233.30
Estimated pulp for 24 hr.		143,927.28
Correction for excess pulp in tanks at end of test		3,590
Cubic ft. of pulp run to presses during test.		140,337+

During the test, 39 determinations were made of the weight of 5 gal. of pulp. The average of these determinations gave the following data:

Percentage of solids in pulp	33.68
Weight of 1 cu. ft. of pulp, lb.	80.60
Solids in 1 cu. ft. of pulp, lb.	27.146

Total solids to presses during test = 140,337 × 27.146 = 3,809,600 lb. = 1,904.8 tons, which was divided among 73 presses, making the average charge 26.09 tons. This scheme of tonnage measurement has been elaborated at our mills during the past eight years, and has found many useful applications. Two more of these may be cited. One, another application in a large way, was described in Transactions of the Institution of Mining and Metallurgy, vol. xxii., p. 201 (1912-13) from which I quote:



Treatment of Slow-Leaching Charge, Homestake Slime Plant.

"At the start the sand vat was completely filled with water. A large tank (1,246 cu. ft.) was arranged so that the entire overflow (equalling in volume the entering pulp) could be switched into it, and the time of filling the 1,246 cu. ft. noted. This tank was filled 53 times at equal intervals during the 48 hours required to fill the sand vat, the total volume of pulp being thence calculated as 92,711 cu. ft. Meanwhile the pulp was systematically sampled by a mechanical cutter, a standardized bucket of 2/3 cu. ft capacity (5 U. S. gallons), being filled and weighed 116 times at equal intervals. The samples were all thrown upon a filter, to be dried and weighed later. The specific gravity of the dry solid was accurately determined. From these data the following computations were made:

(b) Sp. gr. of ore 2.985. Average weight of 116 buckets of 5 gal. = 54.575 lb., or 81.862 lb. per cu. ft. pulp. Average sp. gr. of pulp 1.31, whence 1 cu. ft. contains 29.062 lb. dry sand. 29.062 dry lb. sand per cu. ft. × 92.711 cu. ft. ÷ 2,000 = 1,347.2 tons [sand in vat]

(c) Total dried sand from 116 buckets ...weighed 2,261 lb., or 29.24 lb. per cu. ft. pulp. 29.24 lb. per cu. ft. × 92.711 cu. ft. ÷ 2,000 = 1,355.4 tons.

(a) Tonnage for a depth of 160 in., based on former accepted weight of cu. ft. boxes = 1,344.0 tons. Maximum variation = 11.4 tons = 0.85."

Another convincing demonstration of its accuracy, under more difficult conditions, has recently been noted. A detail of stamp milling was under investigation. Tonnage measurements of the trial battery and of a standard battery were made by diverting the entire flow of a five-stamp battery into a 15-gal. container, noting the time required to fill the container and the weight of the impounded pulp. The time required to fill the container, under these conditions, is from 20 to 25 sec.; the water ratio is over 10:1. Although many repetitions carried conviction of the general accuracy of the observations, it was thought

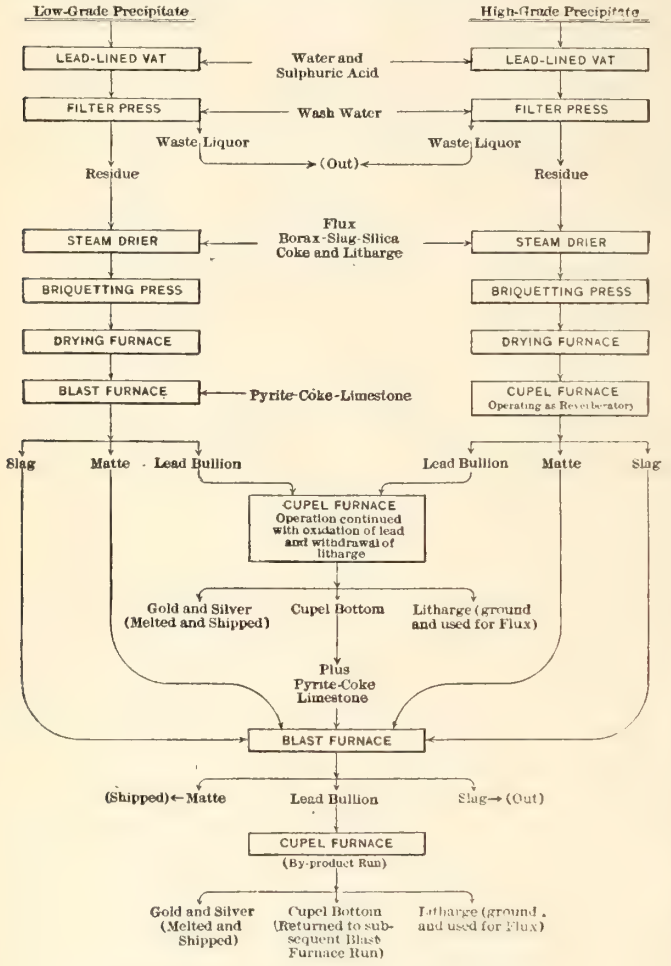
Slime Plant Operating Costs for 1914

	Operating Labor	Other Labor	Supplies	Chemicals	Mines' Labor	Total
Superintendence	$0.0093	....	....	....	....	$0.0093
Assaying	0.0021	....	....	$0.0005	$0.0005	0.0031
Thickening	0.0033	....	....	....	0.0001	0.0034
Neutralization	0.0055	....	$0.0004	0.0144	....	0.0203
Treatment	0.0342	$0.0027	0.0152	0.0433	0.0119	0.1073
Precipitating and pumping solutions	0.0039	0.0006	0.0016	0.0096	0.0008	0.0165
Heating	0.0004	....	....	....	0.0013	0.0017
Refining	0.0026	....	....	....	0.0040	0.0066
Miscellanies	0.0057	0.0009	0.0012	....	0.0010	0.0088
*Repairs	....	0.0042	....	....	0.0026	0.0068
Total Operating	0.0670	0.0084	0.0184	0.0678	0.0222	0.1838

*Mines repairs are carried as Miscellanies; heavy items of repairs necessitating the presence of a carpenter's crew are included here. Press cloths cost $0.0100 per ton of slime treated.

A statement of operating costs at the slime plant is appended. This plant was the pioneer of its type. It

is interesting to note that the presses are now practically as at first designed, and that the process, in its essentials, is unchanged. Certain refinements in the press design have been dispensed with as unnecessary; a study of the operations has made possible some simplification and systematization, which have made it possible to reduce the costs each year.



Refining of Precipitate at Homestake.

Unit Consumptions per Ton of Slime Treated.

Sodium cyanide . . . .0.161 lb.
Zinc dust . . . . . .0.118 lb.
Lime . . . . . 3.84 lb.
Hydrochloric acid . . 0.393 lb., costing $0.0093 per ton treated.
Power . . . . . .1.15 kw-hr.

Precipitation.

The Merrill system of precipitation with zinc dust is used at all cyanide plants, as is the Merrill filter press of triangular section. This method has been fully discussed in the paper already cited, and the technique remains about as there described. It has been mentioned that the effect of the recent variations in treatment has been adverse to precipitation, since the tonnage of solution requiring precipitation has been increased at the same time that the content of solution in gold and cyanide has been reduced. Beyond the natural effects—increased zinc consumption and lower-grade precipitate—no difficulties have been encountered.

Double cloths are used on the frames, the outer one being taken off when the press is cleaned and replaced by the inner cloth, which is in turn replaced by a new cloth. The outer cloth is burned, the ash going to refining.

Experiments are still in progress to find the lightest and cheapest cloth that can be used for this purpose without unduly increasing the hazard of leakage.

All washing of cloths is eliminated by this system. Against the added cost of cloth may be set the advantage of security from leaks due to rotten or wrinkled cloths and the labor of washing soiled cloths.

Refining.

In its essentials, this remains as described in the earlier paper, except that after acid treatment of the lower-grade precipitate, the briquets are charged to the blast furnace instead of being fused in the cupel. The latter treatment is still the standard for precipitate of higher grade.

Acid treatment is a preliminary to furnace treatment of all precipitates. It may not be necessary, but in my judgment it is sound metallurgy, since it enhances security from stack losses and insures more fluid slags. Moreover, the decreased bulk of product to be smelted with lead decreases the time required for that operation, always more or less hazardous to the health of the workmen.

Oil is now used as a fuel in the cupel furnace, replacing wood. It is an ideal fuel for the purpose, and its use has resulted in an acceleration of nearly 50 per cent. in the rate of cupelling.

BOOM IN ANTIMONY.

F. L. Hess, of the United States Geological Survey, describes the unusual situation in antimony as follows:

Before the outbreak of the European war the leading brand of antimony, Cookson's, was quoted in New York at about 7 cents a lb., with other brands ranging from 5.30 upward. The outbreak of hostilities was followed by a rise in prices, and quotations for Cookson's soon rose above 20 cents, and after some fluctuations the year closed with the quotations at 15 to 15.50 cents a lb., and other brands at 13 to 14.40 cents. The British Government placed an embargo on the shipment of antimony and the price rose, so that in May Cookson's was listed at 40 cents or more a lb., but in a few days quotations ceased, for the stock in this country was sold. Quotations for other European brands, Hallets and Hungarian, ceased a little later, leaving the market to Chinese and Japanese (made from Chinese ore), which were quoted in the latter part of June at 37 to 37.50 cents a lb.

The demands for antimony to use in type, bearing (babbitt), and white metals to be used as a foundation for silver plate, coffin trimmings, is large and persistent, and is not satisfied by the Chinese output, although that has been greatly increased.

It seems safe to predict that soon after the close of the war the price of antimony will again drop to or near its ante-bellum level. Most buyers of ores seem to be discounting heavily against this contingency, and many owners refuse to sell at the prices offered, which seem to range from 50 cents a unit (one per cent. of a short ton) for clean ores running 35 to 50 per cent. antimony and $1.00 to $1.50 a unit for ores running above 50 per cent. f.o.b. railroad station near mine.

The permanent good which may be hoped for from the present abnormal situation is that the consequent exploitation may develop some mine with ore bodies rich and large enough to be worked at a profit even at the normal low prices.

The output of bituminous coal in the United States for the first six months of 1915 is estimated by C. E. Lesher, of the United States Geological Survey, to be between 180,000,000 and 190,000,000 short tons, the rate of production having been from 85 to 90 per cent. of the average for the previous year.

THE COAL TRADE IN NOVA SCOTIA DURING THE FIRST HALF OF 1915

By F. W. Gray.

The unusual circumstances of the present time seem to require and to warrant a departure from the time-honored custom of annual trade reviews, and the writer has therefore gathered some approximate statistics showing the production of the coal mines of Nova Scotia during the first six months of 1915, as compared with the corresponding period of 1914.

A tabulation of the production of the various coal companies, over the periods mentioned, is as follows. The figures are closely approximate:

	1st Half 1914. Long Tons.	1st Half 1915. Long Tons.
Dominion Coal Co.:		
Glace Bay Mines	2,254,000	2,075,000
Springhill Mines	200,000	199,000
N. S. Coal & Steel Co. . . .	396,500	256,300
Acadia Coal Co.	207,600	144,000
Inverness Coal & Ry. Co. . .	125,800	103,000
Intercolonial Coal Co. . . .	107,000	90,000
Maritime Coal & Ry. Co. . .	73,500	76,000
Minudie Coal Co.	31,000	38,000
Colonial Coal Co.	26,000	20,000
Cape Breton C. I. & Ry. Co.	12,000	6,000
	3,433,400	3,007,300
Decrease		426,100

These figures disclose a diminution in production of about twelve per cent., and it may be remarked that the major portion of the decrease occurred during the first three months of the year.

The decrease in tonnage for the twelve months of 1914 as compared with the twelve months of 1913, for the Province of Nova Scotia, was about 600,000 tons, and it is a point worthy of note that the reduction in tonnage coincided almost exactly with the lessened use of coal for coke-making. That is to say, the decrease in production of coal was entirely attributable to the lessened activity of the steel trade, as may be gathered from a study of the outputs of the two large Cape Breton operators, namely, the Dominion Coal Company and the Nova Scotia Steel & Coal Company. The same feature is noticeable in the tonnages of the first six months of the present year.

The demand for manufacturing and domestic coal has been well maintained, and has in fact materially increased. Bunker enquiries have been particularly vigorous, as many steamers engaged in transatlantic service are taking double bunkers on this side.

The demand for steel for the fabrication of munitions of war has during the past three months had an enlivening effect upon the steel-making industry, and is now helping the coal demand very considerably.

While the forecasting of future events is perhaps a more unsafe amusement at the present time than it is in more normal times, there seems good reason to hope that the second half of 1915 will not show the same decrease in tonnage as the first half of the year has shown, and may even show a respectable increase in production over the last half of 1914. Indeed, it will not be surprising if, when the twelve months are ended, the coal production of the Province is within one or two hundred thousand tons of the production of 1914.

As is to be expected, there has been a slackening in new construction and development. With the exception of the completion of the new washery of the Nova Scotia Steel & Coal Company at Sydney Mines there has been no notable addition to the equipment of the collieries.

The Cape Breton Coal, Iron & Railway Company suspended mining operations in February last, and it is not probable that operations will be resumed at the Broughton Colliery until after the close of the war, or until financial conditions improve.

The Acadia Coal Company suffered from the temporary loss of the Allan Shafts following the explosion of last December. The recovery operations were successfully carried out, but practically no output has been contributed by the Allan Shaft mines during the first half of the year.

Some of the smaller producers, notably the Maritime Coal Company and the Minudie Coal Company, show a small increase in tonnages over 1914, showing that, as previously pointed out, the local demand for coal has been well maintained.

The cost of freighting coal has been considerably enhanced by the requisitioning of vessels by the Admiralty. This has particularly affected the Dominion Coal Company, as will be noticed from a perusal of the report of the president of the Dominion Steel Corporation to the shareholders presented at the annual meeting in June. The peculiar conditions attending the coal trade in the St. Lawrence and Gulf have evolved a type of coal freighter that is unique. The necessity to deliver large quantities of coal within a period of time strictly limited by climatic conditions has brought into use a type of vessel characterized by large carrying capacity, up to 12,000 tons, and possessing specialized features, such as speed, cargo holds with large clearances, unusual provision of water ballast, etc. These special features have rendered these vessels particularly desirable for the purposes of the Admiralty. At the same time, the impossibility of replacing them by other vessels is telling very severely upon the coal companies.

The shadow of the war is cast upon every feature of industrial life, and it is to be met with in most unexpected places. Large numbers of the mining population have gone to the front. For example, the Dominion Coal Company alone has suffered the loss of over one thousand men, approximately half of this number being comprised of Belgians, Frenchmen, Russians, and other nationals of the Allies, and the other half represented by enlistments in the various Overseas Contingents or in the home militia forces. This number does not include the enlistments at the Springhill mines, where the proporiton of recruits has been as high, if not higher, than in any part of the Province. At Sydney Mines also and Westville enlistments have been heavy, and the mining population of Nova Scotia will compare very favorably with the remainder of the Dominion in their response to the Empire's supreme appeal. As an example may be quoted a case that came under the writer's notice recently, where a miner and his three sons are serving together in one company of the Second Contingent. This man left behind him a wife and seven other children, but considered it to be his duty to go with his three sons, "in case anything should happen to them." The same circumstance is to be noted that has been commented on in English papers, namely, that it is the married men who are enlisting. Many reasons could be given for this fact, but it is a

fact, and the pension list will some day be a grievous reminder of the fact.

In any review of the coal trade of Nova Scotia so largely dependent for its existence on transportation by water, it would be ungrateful not to refer to the services of the navy that is protecting our costs. It is a navy that we never see, whose ships come and go unheralded and unpublished, but so far it has kept us in safety That our industries continue their prosperous operation, and that the "long wharf" of Nova Scotia has not yet sighted a hostile craft, is, and should be, a source of gratitude to all who appreciate the vulnerable nature of our geographical location, and is evidence of the good work of those who patrol the North Sea.

Summarizing the situation, therefore, it would seem that there is reason for optimism as regards the outlook for the coal trade in Nova Scotia, as compared with the outlook six months ago, and there seems good reason to believe that the improvement will continue at least until the close of St. Lawrence navigation.

COLORADO'S MINES BUSY.

The output of Colorado mines during the first six months of 1915, according to Charles W. Henderson, of the United States Geological Survey, will show no increase in actual metal contents, except for gold. The increase in average prices for lead, copper, and zinc, based on the normal production, will, however, add greatly to the total value of the output, and the undoubted activity in mining promises at least the normal production of metals for the year 1915, which at the exceedingly high average prices at this stage of the year, promises a greatly enhanced total production.

Colorado, in the last five years, 1910-1915, has averaged $19,225,500 in output of gold (dropping from $20,507,058 in 1908 to $18,146,916 in 1911, but increasing in 1914 to $19,883,105); silver has averaged 8,400,000 oz.; copper, 7,000,000 lb.; lead, 76,600,000 lb., and zinc, 104,000,000 lb., reaching its height in 1912, with 132,222,812 lb., but dropping to 96,774,960 lb. in 1914. The total value for the five metals has averaged $34,480,000, when silver ranged from $0.53 to $0.615, copper from $0.125 to $0.165, lead from $0.039 to $0.045, and zinc (spelter) from $0.0510 to $0.069.

Cripple Creek annually produces 60 per cent. of the State yield of gold, and in the first six months of 1915, has proportionately exceeded the production of $11,996,116 for the 12 months of 1914. The San Juan region has produced normally on a basis of $4,000,000 per year, and Leadville probably has exceeded its normal gold production because of shipments of siliceous gold ores from Breece Hill mines, while the Clear Creek-Gilpin region has produced slightly in excess of the normal production. The Summit County dredges have maintained a production of about $300,000 for the half year.

A GOOD MINING YEAR IN ALASKA.

In the Geological Survey's mid-year review for 1915, Alfred H. Brooks reports that there is every reason to believe that the mining industry of Alaska has begun a prosperous year. The present high price of copper has encouraged the continuation of development work on many copper properties on which operations were suspended in mid-summer of 1914. It is probable that about a dozen copper mines will be on a productive basis in 1915 compared with 6 in 1914. A considerable increase of copper production will, therefore, take place The gold lode production from the Southeastern Alaska, Prince William Sound, and Willow Creek districts will also be increased this year.

INCREASED MINING ACTIVITY IN NEVADA.

The United States Geological has received reports from V. C. Heikes of satisfactory conditions in Nevada that promise well for the 1915 output of metals. Since May, the mines and mining districts of Nevada are more lively than they have been in years and more ore is being shipped than for months past.

Over 100 cars of ore per month are being shipped from the Yellow Pine district, in Clark County, where nearly every zinc and copper property is working, but zinc producers without contracts for their product are experiencing a hard time selling it at the present high prices. The silver mills at Tonapah are operating at usual capacity, treating about 10,000 tons of ore weekly.

On the Comstock lode the pumps of the Mexican and Ophir winze have lowered the water to the 2,700 level. Nothing that has happened on the Comstock in twenty-five years is of such importance as a vast quantity of virgin ground that has been opened up in the north end mines. Last month the first ore in thirty years was brought up from the 2,500 level of the Comstock. Rochester District is equipped with a custom mill, and recently made a second shipment of silver bullion valued at $26,000 after a run of sixteen days. The Nevada Consolidated mill and smelter at Ely are operating at full capacity. A flotation process has been added to its concentrator.

SPECIAL DEMAND FOR QUICKSILVER.

The quicksilver industry has been active during the first six months of 1915, according to H. D. McCaskey, of the United States Geological Survey. Up to the beginning of the European war the price per flask of 75 lb. in San Francisco had not reached a monthly average of $40 since January, but in August embargoes closed the important foreign sources of supply, except the Italian, and the average was quoted as $80, and much higher prices were quoted for individual sales. In September the price dropped slightly, and in the last quarter shipments came in from Italy to take advantage of the domestic market, and the prices ranged from $53 to $55. Demand increased and supplies were not immediately available, so that in February the monthly average price reached $60, in March $78, falling to $77.50 in April, and $75 in May. Italian supplies could no longer be expected to compete when that country entered the war, and in June the prices rose from $80 to $90.

GOOD OUTLOOK FOR MONTANA MINES.

Soon after August 1, 1914, two of the three copper smelters in Montana closed, and another curtailed production of copper until metal prices improved. Mining and smelting were, however, resumed, as the demand for metal increased, until the production at the end of June, as reported by V. C. Heikes, of the United States Geological Survey, is about 97 per cent. of the normal output. The Anaconda Copper Company announced in April that the point had about been reached where 90 per cent. of the mineral values in the ores are recovered. In May, the Pittsmont smelter was started.

More than 15,000,000 of the 16,500,000 tons of iron ore produced annually in France, worth about $13,000,000, comes from department of the Meurthe and Moselle, occupied by the Germans; 74 per cent. of French iron industries are immobilized.

Even the hens are making and filling shells.—The Wall Street Journal.

DOMINION STEEL CORPORATION, LTD., ANNUAL REPORT

At the annual meeting held on June 24, the directors of the Dominion Steel Corporation submitted the following report:

The net earnings of the corporation and its constituent companies, after making full provision for bad and doubtful debts and after adjustment of the values of materials on hand, were $3,571,058.98. From this amount there has been reserved for depreciation sinking funds and proportion of discount on bonds, the sum of $1,064,279.88. The undivided profits carried forward have been increased by $225,256.24. The business of the Steel Company was seriously disturbed during the year, and the directors were obliged to postpone payment of the dividends on its preferred stock.

The operations of the Coal Company were affected unfavorably by the closing down for some months of the steel plant, but its business was on the whole well maintained. The prospects for the coming year are good, but the requisition of our colliers by the Admiralty is seriously affecting the question of transportation.

In the early part of the year a distinct revival in the demand for iron and steel in Canada was apparent, but business came to a standstill with the outbreak of war. We have as yet experienced no revival of the Canadian demand, but there is a considerable tonnage of steel required for war purposes, and the demands for export trade are large, while prices abroad have risen to a level more in keeping with the heavy cost of transportation. The company is receiving a full share of business in these lines.

The only material addition to the properties since the last annual report is a plant for the recovery of benzol and other hydrocarbons, the erection of which was undertaken in February. This plant, although not quite complete, is producing a considerable quantity of these by-products, which are now greatly in demand. Even under normal conditions the plant should yield a very good return on its cost.

On the whole the directors are pleased to be able to report a marked improvement in the outlook for the constituent companies in the coming year, as the result mainly of the special demands from abroad.

Consolidated Profit and Loss Account.

For the fiscal year ending March 31, 1915.

Net earnings, after deducting all manufacturing, selling and administrative expenses, but before charging provision for sinking funds and depreciation and interest		$3,571,058.98
Deduct — Provision for sinking funds, exhaustion of minerals, depreciation and permanent improvements		920,093.18
		$2,650,965.80
Deduct also: Interest on bonds and loans	$1,051,522.56	
Proportion of discount on bonds and notes sold ..	144,186.70	1,195,709.26
Net earnings		$1,455,256.54
Add—Balance at April 1, 1914.		796,907.07
		$1,652,163.61
Less—Dividends:		
On preference shares ...	$420,000.00	
On preferred stock of Dominion Coal Company, Ltd.	210,000.00	630,000.00
Balance, March 31, 1915		$1,022,163.61

President J. H. Plummer reports on the business of the corporation as follows:

Coal Business.

The output of coal for the year ending March 31st, 1915, was cut down by the closing of the blast furnaces of the Steel Company, so that our figures show a shrinkage for almost the first time on record. The reduction in the Cape Breton Collieries for the year amounted to 541,641 tons; the total production at all collieries for the last four years was as follows:

	Tons.
Year ending 31st March, 1915	4,550,512
Year ending 31st March, 1914	5,047,683
Year ending 31st March, 1913	5,051,603
Year ending 31st March, 1912	4,406,263

The capacity of our collieries on a full summer working basis, is just 500,000 tons per month, and it is hoped that the output in the current year will again exceed 5,000,000 tons.

No new work was undertaken on the coal properties during the war, but in the new collieries in the Lingan district expenditures in the completion of work under way amounted to $75,457.80. This practically completes Nos. 12, 14, 15 and 16. Some further work has been done on No. 17, but under the conditions prevailing it was not thought well to push the development of that colliery. The total capital expenditure for the year was $127,860.55.

During the year we closed one of our oldest collieries, No. 8, where the supply of coal has been exhausted, and the time is approaching when No. 3 must be abandoned. The equipment and organization of the latter are already being transferred to No. 11, which underlies it. I might remind you that as against the loss of the output of these [illegible] collieries as mentioned above, and Nos. 21 and 22 in the Morien district and have also reopened colliery No. 11.

The working of the Springhill Collieries property has been much improved and its value is now fully demonstrated. The opening of the new colliery has been postponed until times improve, but we have contracted for the installation of a modern compressant plant to replace the steam power now used underground, which under the increased depth of our work[illegible] has become inefficient and costly.

The efficiency of the company's arrangements for transportation has been maintained as fully as possible, but we have suffered severely through the requisition by the Admiralty of some of our best colliers. The company has lost in this way the services of the Two Sisters, 3,100 tons dead weight capacity; Kendal Castle, 6,750 tons; Inch Strathnaver, 11,000 tons; Wa[illegible]

mouraska, 7,400 tons; Wabana, 7,400 tons, and Maskinonge, 7,400 tons; a total carrying capacity of 48,050 tons. The completion of the Daghild has been indefinitely postponed by the Admiralty requirements.

These losses interefere seriously with the delivery of coal by water, and while we have been able to secure a number of smaller steamers, chiefly from the upper lakes, the lost tonnage has not been fully replaced, and in any case the cost of transportation must be much increased over last year.

Iron and Steel Business.

For the first two or three months of the fiscal year the operations on the steel plant were fairly active, especially in the rail mill. Immediately after the outbreak of war all orders were suspended, and some material already made was left on our hands to be taken when conditions improve. The business was at a standstill from August to November; orders from Great Britain from that time forward enabled us to keep the plant in partial operation, but the prices obtainable, coupled with the high cost of transportation —due largely to excessive delays in British ports— left little margin of profit. Since the spring set in this condition has greatly changed for the better, and unless we should meet with other unforeseen changes, the large export trade which we have secured should be fairly profitable.

The following shows the output of the year, with the figures of the previous year:

	Year ending March 31, 1915. tons.	Year ending March 31, 1914. tons.
Pig iron	187,262	333,919
Steel ingots	243,313	331,256
Blooms and billets for sale	38,231	35,299
Rails	99,929	176,027
Wire rods	39,762	30,764
Bars	14,319	16,738
Wire	27,175	24,788
Nails	10,912	14,089

Our exports of iron and steel during the year amounted in all to 109,151 tons, in addition to which there were over 20,000 tons on hand on 31st March made on export orders. Notwithstanding the tonnage of materials on hand awaiting shipment under contracts already made, the inventories of the Steel Company were reduced to the extent of $719,435.51 as compared with 31st March, 1914, and we hope to continue the reduction.

The demand for iron and steel in Canada has fallen to a very low point. The depression began in the fall of 1913, it was temporarily interrupted in the spring of 1914, but with the war it became acute. In many departments there is no demand whatever. We have, however, made large contracts for the supply of steel for high explosive shells, on which we are now working.

This condition is not unnatural, if we look back at the extraordinary amount of expenditures in recent years on new railways, additions to existing railways, and railway equipment. A relapse at the close of this constructive period was to be looked for, but it came with a severity and suddenness that no one could have expected. There are, unfortunately, no indications yet of a change in the direction of normal conditions, yet business in the country is on the whole fairly active, our agricultural interests are extremely prosperous, and the natural demands of a population with fair spending power must lead to the revival of a demand for our ordinary products. For rails, however, we must look for our chief markets abroad. I am glad to say that the many railway lines we have served throughout the Empire seem pleased to return to us, and most willing to entrust us with their orders when circumstances permit.

So far as can be judged the demand for iron and steel for the British and foreign markets must be very large during the war, and for a certain period after its close. We are not without hope that the business we are now building up will to a considerable extent be permanent, but a great deal depends on the conditions in Europe when the war is over.

I should add that the difficulties of transportation have formed the chief obstacle to the building up of the export trade. The cost was greatly increased, and at the same time the quantity we could move greatly diminished, by the extraordinary delays and wasted time from which we suffered. The congestion of traffic at British and French ports has in effect almost cut in two the amount of steel which our vessels were able to deliver on the other side.

The only addition to the property in the year is the benzol plant hereafter referred to, but a great number of minor improvements have been effected, all tending to greater economy and efficiency. The effect of this is shown in the favorable costs we have reached this spring, which are lower than for many years past.

We have had before us for some years past plans for the erection of a benzol plant, but before the war the prices for benzol, toluol and similar products were low. Since the war the condition has greatly changed, and we found the erection of a plant desirable. On the 20th February we entered into a contract with the War Office for the supply of toluol, which was subsequently extended to trinitrotoluol, and at once began the erection of the plant at Sydney; a nitrating plant being simultaneously erected by the Canadian Explosives, Ltd., to enable us to carry out our contract. Both plants were erected in record time; about two months for each; and are now in operation. The benzol plant still needs some additional equipment for its full completion, but it is already doing excellent work.

The demand for pit rails, for rail fastenings which are necessary in connection with our export rail orders and for rolled sections somewhat larger than our bar mill will produce, has caused us to undertake the construction of another small rolling mill. This will be ready in ten or twelve weeks; it has been planned so that it can be readily extended as the market grows. If the demand for shell steel should continue this mill will enable us to supply it.

U. S. LEAD EXPORTS.

More than 200,000,000 lb. of lead has cleared for export from the United States during ten months ended April 30. This was a record-breaking tonnage, by a wide margin. Of the total shipped out, 49,989,653 lb. was lead of foreign origin that had been treated in the United States under bond, and 151,497,474 lb was American lead. During April exports of domestic lead amounted to 39,772,895 lb., while foreign lead cleared was 10,265,819 lb. more, against 7,325,686 lb. last year. The value of lead originating in and exported from the United States in the ten months period was $6,153,474 of which $1,801,658 cleared during April. The average export price of April's shipments was 4½ cents a lb.

THE LAKE SUPERIOR IRON RANGES

By P. B. McDonald.

The ordinary facts about Lake Superior iron mining are fairly well known. Most mining men understand that in Northern Michigan and Minnesota are situated a great number of huge iron mines. It is a district equaling the Rand in point of magnitude and vastness. Immense, irregular masses of ore are extracted by a variety of ingenious caving, sub-level, and open-cut systems, and put into railroad cars with a neatness and celerity that is amazing, when the difficulties from water, quicksand, and soft walls are considered. The further characteristics of the district, stock-piling the hoist in winter due to stoppage of the lake steamers by ice, circular concrete shafts sunk by the caisson-and-sand-hog method through deep overburden, the distinct Cornish element among the miners and bosses making for many "Cousin Jack" stories of vast eating proclivities and dialectic peculiarities, etc., are also more or less well known in mining circles.

Variety of Methods.—To a visitor, probably the most extraordinary fact apparent on the iron ranges is the remarkable variety of the mining and of general conditions as witnessed on the different ranges and in different districts of the same range. On the Marquette range, around Ishpeming and Negaunee, are seen old mines that have been producing steadily for a generation, and with some of the same men working that were present when the first shaft was sunk. Perhaps a half-mile away in some flat field another company will be diamond-drilling to a depth of several thousand feet in the expectation of finding ore for a new mine deep down in some fold of the footwall slates. One mine will be hoisting a hard, specular ore that can be extracted by open-stope systems, while the next mine to it will be top-slicing and caving a soft, wet ore that resembles mud in appearance.

In contrast to the vertical shafts customary on all the other ranges, the Gogebic range has some deep inclined shafts, as well as peculiarly formed orebodies seemingly caught between the inclined footwall and intruded dykes which cut across the other formations at an angle.

On the great Mesabi, in a country of flat, swampy wilderness, are the vast open-cuts in which railroad trains circle around in a wide spiral from the sides of the pit and finally get down to the busy steam shovels which take the soft ore directly from the deposit and place it in 50-ton steel cars for shipment to docks at the head of the lakes.

Of late years one of the most active [illegible] Lake Superior districts has been that around Iron River, Michigan. Only a few years ago, Iron River was a sleepy, disregarded little place, with one or two indifferent mines and no particular prospects. To-day it boasts of fifteen or twenty different mining companies, with big, well-equipped mines and all kinds of activity, including two railroads, a street car line, new buildings, pavements, banks, etc. The bringing about of this change has been due to the work of the diamond drill, which found unexpected thicknesses of a medium grade ore scattered in the tabular masses under a hundred or two hundred feet of surface soil of the farms of settlers and residents. When the surprising richness of the Iron River field began to be known through the [illegible] operations of two or three pioneers, iron mining companies on the other ranges and farmers interested in the East sent prospectors to the district followed by trained executives, who started acquiring, exploring and developing properties until quite a boom materialized.

Administration.—The iron mining companies are well administered by capable, sensible staffs of employees. There are a number of level-headed old Cornishmen among the officials at the mines, who know mining from generations of mining forbears. Engineers from the nearby Michigan College of Mines, Minnesota School of Mines, and Wisconsin University, are plentiful both on surface and underground, surveying, exploring, cutting costs, etc.

The miners include Finns, Austrians, Italians, Poles, Slavs of several types, with a sprinkling, in the older towns, of Cornishmen. In addition the region has drawn an element of native-born Americans from the nearby lumbering and farming sections—bright-eyed clerks, woodsmen, men of contracting proclivities, who all tend to make for efficiency and satisfactory conditions. It will be remembered that, when the copper miners of Michigan went on their long and disastrous strike, the iron miners refused to strike with them.

The exploration phase of the ore business is important. As the outcroppings and obvious showings of the ore formation became taken up, recourse was made more and more frequently to the diamond drill for probing at depth by vertical, angle, and flat holes, under [illegible] overburden, into favorable folds of the footwall slates for concentrations, and around the various dykes of diabase and diorite. Several companies maintain their own diamond drills, crews, geologists, etc. The Cleveland Cliffs Iron Company is very complete in all its appointments for finding, mining and transporting ores to the markets of the lower lakes. Most companies let their diamond drill exploration to contractors who furnish all equipment, men, etc., and do the work for two, three, four or five dollars per foot, depending on the formations to be cut, distance from railroads, etc. Cole & McDonald, of Virginia, Minn., one of the largest of the diamond-drilling contractors, have dozens of drills at work on all the ranges and in the copper country. The Longyear Company, of Minneapolis, is a large exploring company which also manufactures diamond drills at a shop in Marquette, Mich., and will guarantee to furnish expert geological advice as to the best way of drilling a property. Lately the Longyear interests have been branching into the mine owning and operating end of the business.

U. S. Steel Co. Interests. The recent decision in the United States Courts declaring the United States Steel Corporation not a "monopoly" makes pertinent the corporation's position on the iron ranges. Way back in the 90's several far-sighted business men identified with [illegible] interests around Pittsburg began to realize that iron and steel manufacturing was consuming vast quantities of iron ore, but that the ore fields of Lake Superior had been overlooked due to attention being concentrated upon other phases of the industry. A man named Henry Oliver went to Andrew Carnegie and told him that the great new properties in Michigan and Minnesota "did not come within its geographical and geological limits," and offered him the same options on extensive tracts containing possibilities of ore-bodies. Mr. Carnegie was not much impressed, and declined to be interested. But some time later the Steel Company's [illegible] arrived at the shrewd

opinion that the proposition was sound. He summoned Oliver and told him he had decided to take over his ore land options at the price named. Oliver replied that since their last interview the price for the lands had gone up something scandalous, realizing that Carnegie had determined to pay. Carnegie paid, and thus was formed the nucleus for the enormous ore holdings that were later consolidated into the Steel Corporation.

No monopoly.—But contrary to past opinions, the Steel Corporation has not a monopoly on Lake Superior ore reserves. It is true that of the total shipments each year, the Oliver Iron Mining Co. (which is the iron mining end of the Steel Corporation in the district, and incidentally was named for the same Henry Oliver who interested Carnegie) frequently contributes slightly over 50 per cent.; but the independent operators are increasing every year, and are getting stronger while the Steel Corporation stands still. In 1912 R. C. Allen, the State Geologist of Michigan, after a careful estimate, stated that of the known iron ore reserves in the State, of merchantable grade at that time, the Steel Corporation controlled about 28 per cent. In Minnesota, particularly on the Mesabi range, the corporation is stronger than in Michigan, but by its recent relinquishment of the Hill leases its holdings were materially reduced.

When the Steel Corporation was formed in 1901, nearly all of the then largest iron mines were purchased, and both in Michigan and Minnesota the "Oliver Company" became the dominant factor in the mining field.

Wholesale provision for the immediate improvement and efficient operation of these mines was made on the same elaborate plan as marked all of the corporation's early activities, but the general rule was followed of retaining the old officials to manage the mines. These staffs of officials found the task of administering such a large combination of plants to be greater than had been supposed, and naturally as time went on and their ambitions having been satisfied as to being the largest operators in the field, they sat back and became conservative. Then a crop of new and energetic mining concerns entered the field, as other iron and steel interests saw the advantage of owning their own ore mines; and the several companies that had stayed out of the combination were quietly at work acquiring likely lands, exploring, developing, and producing. In a few years the Steel Corporation became known among mining men as standing for the principle of "let well enough alone," and it was evident that the vast organization was satisfied to merely hold what it had acquired, and was willing to let competition take its course unmolested in any but a friendly manner.

Of course, had the area of iron ore possibilities at Lake Superior been small and confined, or even definitely determinable, the Steel Corporation would have had no compunctions against going right in and scooping up all in sight. But in spite of much geological mapping and careful detailed tracing of the different rock formations by able, experienced geologists, such as President Van Hise, of Wisconsin University, and Professor Smythe, of Harvard, there remains to this day considerable areas where, due to the thick overburden of glacial sand and surface soil, it is impossible to say whether or not iron ore can exist, without expensive and protracted drilling to depths of hundreds of feet.

There are six principal ore ranges, three in Michigan called the "old ranges" and three in Minnesota, besides several outlying districts usually classed as auxiliaries to the main ranges. Thus in Michigan, the oldest range of all, the famous Marquette has an offshoot to the southeast, commonly styled the "Swanzy Range," or the "Gwinn district," while between the Republic trough of the southwestern portion of the Marquette Range and the Crystal Falls area of the Menominee Range is a wild, trackless patch of territory which may or may not contain valuable bodies of merchantable ore. And the discoveries by numerous "independent" companies in the Iron River field of deposits beneath flat farming lands, substantiates the truth that in the Lake Superior soil-covered territory "you never can tell." An added factor which has made for diversity of ownership during late years at Lake Superior is the presence of numerous owners of farms and tracts of land acquired in various ways, by lumbering, settlement, etc. By this multiplication of owners over an extensive area of two States, the conditions were unfavorable to the acquisition by one large company of all likely and promising land for holding or tying up in reserve.

The three Michigan ranges, or "old ranges" are the Marquette, Menominee, and Gogebic, named in order of their settlement and opening up. The three Minnesota ranges are: The Vermilion, an old hard-ore range of no great size; the famous Mesabi, a producer of soft ores, the largest of all six ranges, and the Young Cuyuna, down near the Mississippi river.

From Brainerd on the Cuyuna range in Central Minnesota, to Negaunee on the eastern end of the Marquette Range in the northern peninsula of Michigan, is over 300 miles as the crow flies, or twice the length of the State of Massachusetts, and between these two extreme points lie the complicated and ramified chains of ore deposits which, with appendages and possibilities are grouped into "ranges." It is thus apparent that it was, and is, a very difficult job to corner the Lake Superior iron ore reserves, extending as they do over a vast territory with the land cut up by hundreds of ownerships of settlers, lumber operators, farmers, etc.

Incidentally it is interesting to note that the Steel Corporation's new steel plant at Duluth is approximately at the centre of the mining region, the only steel plant which has been located in the ore territory rather than in the coal district.

BRITANNIA MINE.

The Britannia Mining & Smelting Company, Howe Sound, B.C., is arranging to install in connection with the mine haulage system a motor-generator set for supplying direct current at 550 volts to the trolley. This set will consist of one 300 kw., 600-volt commutating pole type railway generator, 900 r.p.m. direct-connected to one 500 kw.a. self-starting synchronous motor, 3-phase, 60 cycles, 6,600 volts. One 15 kw., 125-volt commutating pole exciter will also be mounted on the same shaft with the main machines. This unit will be of the 3-bearing type, and the motor end of the shaft will be extended for the reception of the runner of an impulse water wheel which may be installed at a future time. The synchronous motor will have a large capacity for power factor correction. These features will make the set very complete, inasmuch as the synchronous motor may be used as an alternating current generator, and when the water wheel is in operation it would be unnecessary to use a hydraulic governor, as the synchronous motor, being attached to the main alternating current system, will maintain a constant speed.

PROGRESS OF MINING IN BRITISH COLUMBIA

The year 1914, during its first half, gave promise of being an exceedingly favorable one for mining in British Columbia, and it was even expected that its mineral production would exceed that of any previous year. These expectations, however, were shattered by the unprecedented conditions which confronted the mineral industry during the last half of the year.

The production for 1914, although it is materially less than for the years 1912 and 1913, is nevertheless about the same as for the year 1910, while it is considerably greater than that of any other year and is much greater than the average production for the last ten years.

The decrease shown this year, while it is partially caused by a lesser quantity of the metals produced, is not entirely attributable to that cause, but is partially due to the lower average price of the metals prevailing in 1914 as compared with those of 1913. For example, the average market value of silver in 1914 was about 4.9 cents an oz. lower than in 1913; copper was 2.27 cents a lb. lower; lead, 0.5 cent a lb. lower; zinc, 0.45 cents a lb. lower. If the metal prices of 1913 had been maintained during 1914 and applied to the output for that year, this output would have been valued at some $1,170,117 greater than it appears. The lower average prices for the metals prevailing in 1914 are partially attributable to the war, but to some extent were occasioned by the financial stringency which preceded the war and possibly foreshadowed it.

The gross value of the mineral production for 1914 was $26,388,825, a decrease from that of the year 1913 of $3,907,573, or about 12.2 per cent.

The tonnage of ore mined in the lode mines of the province during the past year was less than that of 1913. The ore mined amounted to 2,175,971 tons, showing a decrease from that of the previous year of 487,838 tons.

The tonnage mined in 1914 was produced by the various districts in about the following proportions: Boundary, 50.3 per cent.; Rossland, 13.6 per cent.; Cassiar, 12.1 per cent.; the Coast district, 11.7 per cent.; Slocan district, 4.7 per cent.; Ainsworth, 3.1 per cent.; Nelson, 2.7 per cent.; East Kootenay, 1.7 per cent.; and all other parts of the province combined, 0.1 per cent.

The following table shows the number of mines which shipped ore during the year 1914, the districts in which they are situated, and the tonnage produced in each district, together with the number of men employed, both above ground and underground:

Grand Forks, Greenwood, and Osoyoos ..	1,093,229	12	10	568	284	852
Ashcroft - Kamloops ..	279	1	1	20	12	32
Similkameen - Vernon	150	1	1	3	4	7
Lillooet	120	1	1	4	2	6
Coast	256,463	7	6	248	365	613
Total	2,175,971	98	56	2,604	1,350	3,954

In explanation of the table it should be said that, in its preparation, a mine employing twelve men for four months is credited in the table with four men for twelve months, so that the total given is less than the actual number of individuals who worked in the mines during the year.

TABLE SHOWING B.C. NON-SHIPPING MINES AND MEN EMPLOYED

District	Number of Mines Working	Idle	Total	Men Employed Below	Above	Total
Coast and Cassiar	3	9	12	24	11	35
East Kootenay	..	2	2	..	..	..
Ainsworth	5	5	10	16	6	22
Slocan	8	16	24	37	12	49
Nelson	2	8	10	8	2	10
Trail Creek	2	7	9	7	5	12
Lardeau	2	3	5	3	1	4
Boundary	7	21	28	41	45	86
Lillooet	1	1	2	1	1	2
Total	30	72	102	137	83	220

QUANTITIES AND VALUES OF MINERAL PRODUCTS OF BRITISH COLUMBIA FOR 1913 AND 1914

	1913 Quantity	1913 Value	1914 Quantity	1914 Value
Gold—				
Placer, oz. .	.....	$510,000	.....	$565,000
Lode, oz. ..	272,254	5,627,490	247,170	5,109,004
Silver, oz. . . .	3,465,856	1,968,606	3,602,180	1,876,736
Lead, lb. . . .	55,364,677	2,175,832	50,625,048	1,771,877
Copper, lb. ..	46,460,305	7,094,489	45,009,699	6,121,319
Zinc, lb.	6,758,768	324,421	7,866,467	346,125
Coal, tons	2,137,483	7,481,190	1,810,967	6,338,385
Coke, tons ...	286,045	1,716,270	234,577	1,407,462
Miscellaneous products . .	.....	3,398,100	.....	2,852,917
		$30,296,398		$26,388,825

THE COPPER INDUSTRY HIGHLY PROSPEROUS.

The mid-year review of the copper situation by B. S. Butler of the United States Geological Survey regards a general betterment in the six months period.

At the beginning of the year 1915 most of the large copper producing companies of the United States had for nearly five months been operating on a 50 to 60 per cent. basis, and probably none were producing at normal capacity. A considerable proportion of the smaller producers had shut down their plants, where they could be done without great loss. Developments and improvements had been generally suspended. Copper was selling below 13 cents a pound and had been considerably lower. Wages had been reduced in most of the camps and many men had been either laid off or were employed only part time.

Soon after the first of the year, however, there was a notable improvement in the demand for copper, and the price has rather steadily advanced from below 13 cents to about 20 cents a pound, the highest point reached since 1907. With the increase in demand and the advance in price, there has been a corresponding steady increase in the production of the metal, and at the present time most of the larger producers have brought their output to normal, while many of the smaller producers have resumed operations. The output of copper has also probably nearly or quite reached the normal. Wages have been raised in the camps, where reduction had taken place, and the industry in general is in a highly prosperous condition.

THE BRITISH COLUMBIA COPPER COMPANY'S SMELTER, GREENWOOD, B.C.*

By Frederic K. Brunton.

The smelting plant of the British Columbia Copper Co. at Greenwood, B.C., now closed because of the decline in the price of copper due to the European war, is of special interest to metallurgists for several reasons.

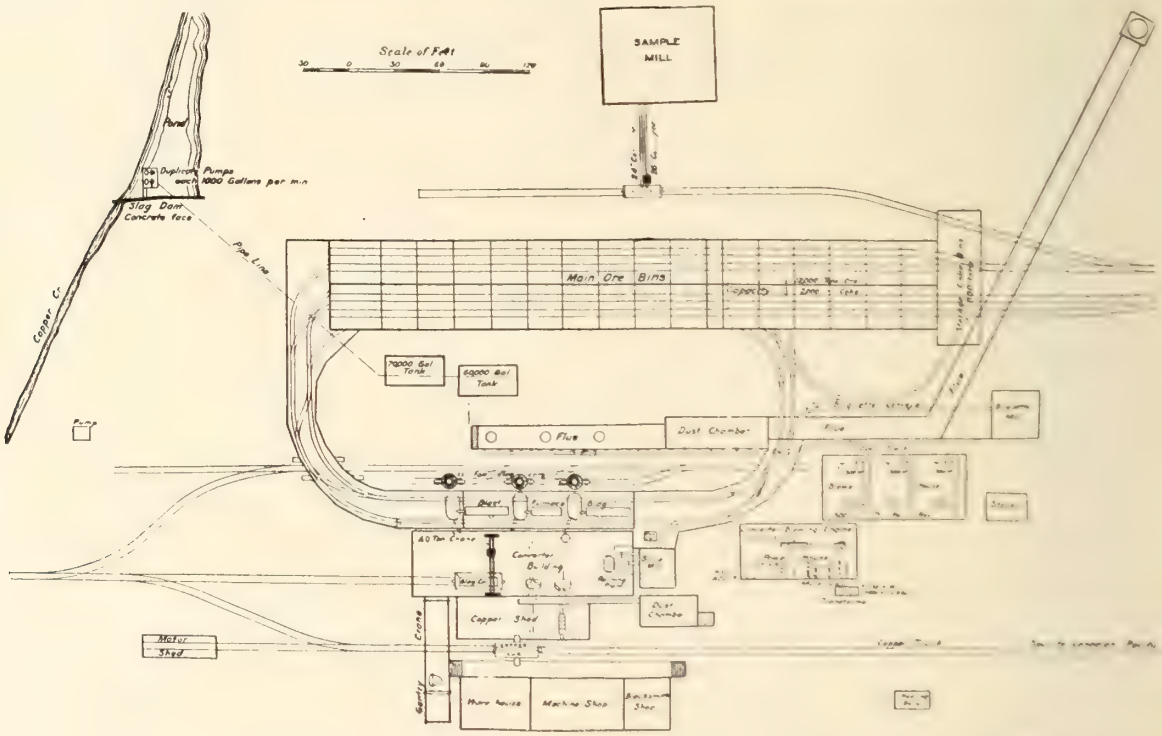
It was successfully smelting in blast furnaces the lowest grade copper ore of all plants in America. In order to do so, it had to run at very high efficiency, which necessarily required a large tonnage per square foot of hearth area, together with the minimum amount of labor and other costs.

The furnaces smelted daily 2,250 tons of ore (6.62 tons per sq. ft. of hearth area), carrying 0.85 per cent. of copper, at a smelting cost of $1.18 per ton. The entire plant required 130 men to operate it and keep up repairs, showing a labor efficiency of about 17.5 tons per man per day.

In the present paper, the method of obtaining these results is shown. Most of the information contained in this description I obtained as assistant superintendent, during the two years preceding the present shutdown. Other sources of information to which I am indebted are: The British Columbia Copper Co., Ltd., by Alfred W. G. Wilson, in the Copper Smelting Industry of Canada; Greenwood Smelting Works, by J. E. McAllister, Engineering and Mining Journal, vol. xci., pp. 1011 to 1015 (May 20, 1911); and Description of the Copper Smelter of the British Columbia Copper Co., by W. L. Bell, in Transactions of the Canadian Mining Institute, vol. xvi., pp. 151 to 154 (1913).

Locations and connections.—The smelter of this company is about half a mile south of Greenwood, in the Boundary district of British Columbia, on the Columbia and Western branch of the Canadian Pacific Railway. It was originally built in 1900 by Paul Johnson, to handle 600 tons of ore a day in two small furnaces of 300 tons capacity; but in 1907 the old furnaces were torn out, the plant was remodelled, and three blast furnaces of 48 by 240 in. area at the tuyeres were installed. In 1910, two of these were enlarged to 51 by 360 in. and the other to 51 by 240 in., making the total smelting capacity about 2,400 tons per day.

The Canadian Pacific Railroad delivered ore and coke to the smelter, which is situated on a hillside above the valley, by eight of the nine spurs of track which enter the plant at three different levels; the ninth spur, coming into the plant on the lowest level,



Ground Plan of Reduction Works, British Columbia Copper Co., Greenwood, B.C.

took care of the incoming supplies, converter slag, and copper shipments. The ore as received was either dumped into the bins above the sampling works or directly into stock bins above the charging floor of the smelter. The sampling mill was served by three of the nine spurs, one of which, running over a 200 ton bin, brought ores from the company's own mines, while another, running over two small bins of about 60 tons capacity, was used for custom ores.

Blast Furnace Department.

Blast furnaces.—The blast furnace building is 150 ft. long by 60 ft. wide and contains three water jacketed blast furnaces placed end to end, with space between them for the minor axes of a 10 by 18 ft. oval settler. The two outside furnaces, Nos. 1 and 3, are each 51 by 360 in., while the middle one, or No. 2, is 51 by 240 in. in area at the tuyeres. The vertical distance from the centre of tuyeres to the feed floor is 16

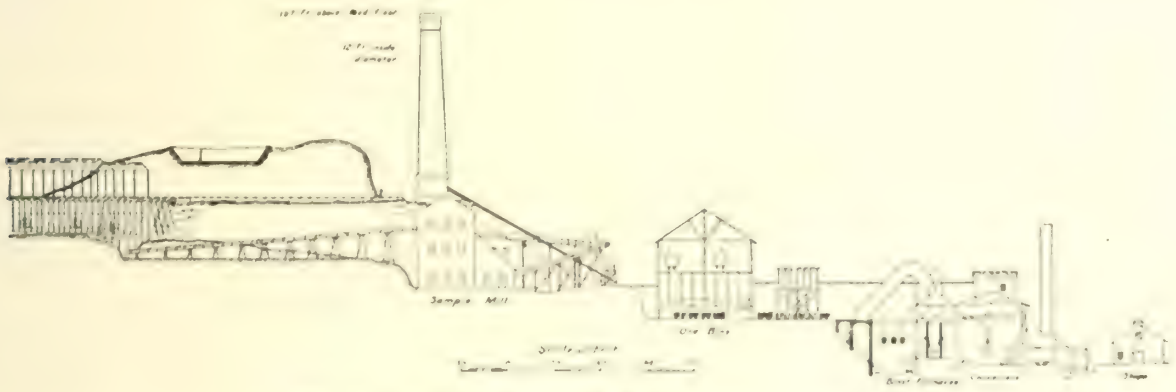
*Extracts from a paper to be read at the San Francisco Meeting, American Institute of Mining Engineers, Sept., 1915.

ft., and to the sole plate 37 in., the other furnace dimensions being as follows:

	30-ft. Furnace	20-ft. Furnace
Hearth area, sq. ft.	127.5	85
Centre tuyeres to tapping floor	5 ft. 3 in.	5 ft. 3 in.
Height bottom jackets	9 ft. 0 in.	9 ft. 3 in.
Width of side jackets	3 ft. 4 in.	3 ft. 4 in.
Width of end jackets bottom.	3 ft. 8 in.	3 ft. 8 in.
Width of end jackets bottom.	6 ft. 2 in.	6 ft. 2 in.
Number of tuyeres	72	48
Diameter of tuyeres	4 in. bushel to 3¼ in.	
Area of tuyeres	597.4 sq. in.	602.9 sq. in.
Tuyere area per sq. ft. of hearth area	4.65 sq. in.	7.09 sq. in.
Centre line to centre line tuyeres	9.25 in.	9.25 in.

Water space in jacket, 4 in.; plate used on inside ⅝ in.; on outside, ⅜ in.

The furnaces and settlers are set upon concrete foundations about 4 ft. above the converter floor. The settlers are 10 ft. wide, 18 ft. long and 4 ft. 8 in. deep, lined on the bottom with a layer 6 in. deep of chrome bats ground up and tamped in with clay, and this covered with a course of firebrick set on end, and on the sides with two courses of chrome brick, backed by crushed silica, for about 22 in. above the bottom. Above that line silica or firebrick are used instead of the chrome brick, except directly under the slag and matte spout of the furnace, and under the settler slag discharge spout. The top of each furnace is connected with a dust chamber of 550 sq. ft. cross-section by a sheet steel downtake, 7 ft. in diameter, in the form of an inverted V. This dust chamber is hopper bottomed, and the dust was drawn off in a small steel mine car and trammed to the briquet mill, where it was mixed with about 3 per cent. water and made into briquets in a White three-plunger press, having a capacity of 5 tons per hour, and driven by a 40 h.p., 550 volt, induction motor. The briquets were fed back to the furnaces again [illegible] since they contained about 70 per cent. of coke dust. The flue dust recovered amounted to about 11½ per cent. of the total charge fed to the furnaces. The gases from the dust chamber passed through an uptake flue 180 sq. ft. in cross-section to the stack, which is 121 ft. high, with an inside diameter of 12 ft. The total height of stack above the top of the furnace charge floor is 200 ft., which, under normal conditions, gave a good draft and kept the feed floor free from fumes.



Section through Reduction Works at Greenwood.

Operation of the furnaces.—The ore and coke were charged into the furnaces from the side, the furnace door being lifted by compressed air. The cars of coke were dumped first, and the train was then backed up and the ore dumped. The charge fell against baffle plates, suspended on both sides of the furnace on 4 in. heavy hydraulic pipe, which is supported by the end castings of the furnace on a level with the charge floor. To insure further the even distribution of the feed, the furnaces were fed first on one side, then on the other. When the plant was running under normal conditions, the two 30 ft. furnaces smelted from 12 to 16 5,000 lb. charges an hour, or about 112 charges per shift, each, and the 20 footer from 8 to 12 5,000 lb. charges per hour, or 80 per 8 hour shift, making a total of 912 charges of 5,000 lb., or 2,250 tons, per day. The blast varied from 16 to 24 oz., according to conditions, and was supplied by three No. 10 Roots blowers, each having a capacity of 25,000 cu. ft. per minute running at 88 rev. per minute and belted by a 40 in. leather belt to a 300 h.p., 2,200 volt, induction motor. The blowers are so arranged that, through a common header, any blower could be used on any furnace, the air going in iron pipes, 43 in. in diameter, from the header to the furnace bustle pipe, which extended around both sides of the furnace.

The slag and matte ran out of the furnaces at the end through a water-jacketed copper breast jacket and thence through a water-jacketed spout with a water cooled copper lip, into the settler. The spouts are set to have about a 7 in. trap. The slag overflowed continuously into a cast iron pot of 250 cu. ft. capacity, held from 20 to 25 tons of slag, and mounted on standard gauge trucks, in which it was hauled to the dump by a 35 ton, 240 h.p. Baldwin-Westinghouse locomotive, and there dumped by means of a 15 h.p. D. C. motor, operated from the cab of the locomotive through "jumpers." While one pot was being removed from the settler and another one spotted, the slag was caught in a cast-iron spoon, supported upon a swinging arm and operated by hand from the side of [illegible] stream and dumped its contents into the empty pot after the change was completed.

The labor required to operate the three furnaces per shift was as follows:

Kind of Labor	Number of Men	Wages per Shift	Cost per Ton Ore Smelted
Shift boss	1	$4.50	$0.79
Furnace men	[illegible]	3.00	0.53
Furnace helpers	[illegible]	2.00	0.35
Slag motorman	1	1.48	0.27
Pig [illegible]	1	1.08	0.19
Cinder motorman	[illegible]	1.[illegible]	0.[illegible]
Dust loaders	[illegible]	1.12	0.[illegible]
Second loaders	3	3.00	0.00
Feeders	1	1.00	0.18
Blower	1	1.[illegible]	0.[illegible]
Power house	1	1.40	0.25
Total	21		$3.70

In addition, there were, on the day shift only, four men in the briquet mill and four men grading on the slag track. Of these, six received $2.75 and the other two $3.50 a day, making a total of $23.50. These two crews were also used, whenever needed, in general roustabout work around the plant; so that not all of their time was really chargeable to the furnaces.

Furnace Charge, B. C. Copper Co.

An average furnace charge was about as follows:

Ore	Lb.	SiO_2 Per Cent.	SiO_2 Lb.	Fe Per Cent.	Fe Lb.	CaO Per Cent.	CaO Lb.	S Per Cent.	S Lb.	Cu Per Cent.	Cu Lb
Motherlode	2,500	32	800	18	450	22	550	2	50	1.0	25.0
Rawhide	1,600	36	576	16	256	19	304	3	48	1.2	19.2
Napoleon	500	30	170	30	150	7	35	17	85	0.2	0.5
Republic, SiO_2	400	80	320	..	..	7	28	..	..	..	..
Total	5,000		1,846		856		917		183		44.7

This gave approximately 4,300 lb. of slag carrying off 0.23 per cent. or about 10 lb. Cu, and leaving 34.7 lb. for the matte, which required one-fourth of its weight, or 8.7 lb., of sulphur. By reason of the poor construction of the furnaces for handling ores so low in sulphur, 88 per cent., or 160 lb., of the sulphur was volatilized in the furnace, leaving 23 lb. for the matte. Since the Cu took 8.7 lb. of S, there was left for iron 14.3 lb. of S, requiring 1.75 times its weight, or 25.0 of iron. The matte, therefore, contained: Cu, 34.7; S, 23.0; and Fe, 25.0 lb., and assayed 42 per cent. Cu. The slag ran approximately as follows: SiO_2, 42.7; Fe, 19.7; CaO, 21.2; Al_2O_3, 9.0; and Cu, 0.23 per cent.

In the above charge the most variable factor was the Motherlode ore, in which SiO_2 varied from 17 to 38, iron from 15 to 33, CaO from 7 to 22 per cent. Since this ore would change, sometimes in an hour, from a lime gangue to an iron gangue, carrying about 30 per cent. magnetite, the furnaces required constant watching. The storage facilities were so small that the ore was always smelted before the assays were cut; and this made it necessary to be able to determine the composition of the charge by the physical appearance of the matte and slag and the condition of the furnaces, so that the charge could be changed to meet requirements at a moment's notice.

Resume of Furnace Operating Data, B. C. Copper Co.

Tons smelted per day, 2,250.0; tons smelted per sq. ft. of hearth area, average, 6.62; tons smelted per sq. ft. of hearth area, maximum, 8.70; tons smelted per man per day, 35.70; Cu, on charge, per cent., 0.8 to 1.2; Cu in matte, per cent., 30.0 to 45.0; Cu in slag, per cent., 0.22 to 0.27; S on charge, per cent., 2.00; S burnt off, per cent., 85.00 to 90.00; coke used on charge, per cent., 12.00 to 14.00; coke ash, per cent., 20.00 to 28.00; blast, cu. ft. per minute, 25,000; blast, temperature, atmospheric; cooling water for jackets, gallons per minute, 2,500; men per 8 hour shift, 21.0; matte, per cent. of total charge, 1.65; matte, specific gravity, 5 to 0; slag, per cent., SiO_2, 38 to 45; slag, per cent. Fe, 13 to 20; slag, per cent. CaO, 20 to 26; slag, per cent. Al_2O_3, 6 to 9; slag, specific gravity, 3 to 2.

Converter Department, B. C. Copper Co.

The converter building is 150 ft. long by 44 ft. in width, stands parallel to and about 4 ft. lower than the blast furnace tapping floor, and contains the following equipment:

Two hydraulic converter stands; seven converter shells, each 84 by 126 in.; a 40 ton Niles electric traveling crane, a 6 ft. Carlin silica mill driven by a 40 h.p., 550 volt induction motor, a pneumatic tamping machine, copper casting trucks, slag and matte pots, and a set of platform scales for weighing the blister copper. The converters were lined with siliceous gold ores from Republic, Wash., or from the Snowstorm mine in Idaho, mixed with local clay, as a binder, in the Carlin mill. The life of a lining was from two to three charges.

The matte, containing from 30 to 45 per cent. Cu, was tapped from the settlers into 5 ton ladles, handled by the Niles crane, and poured into one of the converters, where from two to three ladlefuls were blown to blister copper at one heat. The slag was poured off into old matte ladles and was cast in hollows in the ground into buttons, which when cool enough, were lifted by the crane, placed on grizzlies over 50 ton steel dump cars, and there broken up, with hammers, small enough to pass through the grizzlies. These cars, when full, were switched out over the ninth and lowest railway spur, which is 61 ft. below the intermediate level referred to before, and taken up to the main smelter bins, where the material was dumped and subsequently smelted in the furnaces.

The blister copper was cast into slabs, weighing approximately 360 lb. each, in cast-iron moulds mounted on trucks (five moulds to each truck) which ran on tracks under the converters. The copper slabs were weighed, loaded in box cars spotted on the lower spur, near the copper scales, and shipped East to be refined. The lower spur runs between the converter building and the machine shops and warehouse, and was also used for receiving incoming supplies.

The gases from the converters passed off into an iron flue, connected with an expansion chamber of 281 ft. cross-section, and thence into a steel stack 72 in. in diameter and 75 ft. high; the flue dust collected being fed back into the molten converter charge.

The converter department produced per day about 30,000 lb. of blister copper, carrying about 7 oz. of gold and 30 of silver per ton. It required a crew of 21 men which, divided as follows into two 8 hour shifts, was able to handle all the matte produced:

Kind of Labor	Day shift 7 A.M. to 3 P.M.	Afternoon shift 3 P.M. to 11 P.M.
Foremen	1	0
Converters	2	2
Crane	2	2
Laborers	3	1
Lining	5	3
Total	13	8

Power was purchased from the West Kootenay Light & Power Co. on a wattmeter basis and usually came from the Bonnington Falls power plant, about 85 miles away. It was brought by two 3-phase, 60 cycle, 60,000 volt high tension lines, to their Greenwood substation, where it was transformed to 2,200 volts, at which intensity it was delivered to the smelter power house, to be used direct, or further transformed to suit the individual motor supplied.

The power house is divided into two parts, one of which contains the Roots blowers for the furnaces already described, and the other a cross-compound Nordberg blowing engine for the converters, having a

40 in. air cylinder, 42 in. stroke, and a capacity of 5,000 cu. ft. per minute at from 8 to 10 lb. pressure per sq. inch, driven with a rope drive by a 300 h.p., 2,200 volt Canadian General Electric variable speed induction motor. A compound duplex Canadian Rand compressor of 340 cu. ft. capacity, belt-driven by a 50 h.p., 550 volt induction motor running at 150 rev. per minute, supplied air at 80 lb. pressure for the converter tampers, the blast furnace doors, the pneumatic hammer in the blacksmith shop, and for odd jobs around the plant where compressed air was required. Direct current at 250 volts for the crane, slag locomotive, charge-train motors, and an electric arc for burning frozen tap holes and furnace connections was supplied by two of three motor-generator sets working in parallel, one of 75 kw., and the other of 150 kw. capacity, the third, of 100 kw. capacity, being held in reserve. The Gould hydraulic accumulator, with a ram 24 in. in diameter and a 10 ft. stroke, for tilting the converters, was operated by a triplex plunger pump, 5 in. in diameter, with an 8 in. stroke, running at 60 rev. per minute, with a capacity of 120 gal. per minute at 200 lb. pressure, belt driven by a 20 h.p., 550 volt induction motor.

General mechanical equipment.—The plant has a well equipped machine and blacksmith shop, where almost all repairs could be made. The shop contains one large and one small Bertram lathe, one large and one small radial-arm drill press, one large and one small pipe threader, and a planer, a bolt cutter, splitting shears, and a 1½ ton air hammer, together with forges, and all ordinary tools of an up-to-date shop, including a portable oxyacetylene welding outfit. There is also a carpenter shop and an electrical shop, where motors are rewound and general repairs made.

The mechanical crew consisted of a master mechanic, one machinist, one blacksmith, one carpenter, two electricians, one blacksmith helper, one carpenter helper and seven machinist helpers, making a total of 15 men to keep the entire plant in repair.

Costs.

The following costs do not include overhead expenses, depreciation or insurance:

Cost per ton of smelting ore to matte*	$1.18
Cost per lb. of copper of converting matte to blister	0.0048
Cost per ton of copper of converting matte to blister	9.60
Cost per ton of smelting ore to blister copper	1.23
Cost per ton of copper to produce blister copper	0.105
Cost of coke per ton of ore smelted to matte	0.851
Cost of flux per ton of ore smelted to matte	0.111
Cost of labor per ton of ore smelted to matte	0.15
Cost of power per ton of ore smelted to matte	0.033
Cost of supplies per ton of ore smelted to matte	0.03
	$1.178
Cost of coke per ton f.o.b. smelter bins	$6.00
Cost of flux per ton f.o.b. smelter bins	2.50
Cost of power per kilowatt-hour	0.0065

Briquet mill handled 1,057 cars of blast furnace flue dust and made 398 tons of briquets.

Briquet cost $0.945 per ton for labor.

Distribution of smelter payroll for same month and cost of labor per ton of ore smelted:

	Payroll Distribution	Cost of Labor per Ton of Ore Smelted
Sample mill	$318.05	$0.00462
Bins	729.35	0.01060
Briquet	376.65	0.00546
Furnaces	6,598.35	0.0958
Slag disposal	1,413.65	0.0206
Linings	615.60	0.0078
Converters	1,016.85	0.0147
Crane	277.25	0.00403
Water system	224.65	0.00326
General surface	430.15	0.00624
Power house	585.60	0.00850
Total	$12,496.15	$0.18161

*Note.—The furnaces were slowed up with an excess of silica on the charge because of shortage of ore, hence the higher cost per ton of ore smelted to matte. They only smelted 6.55 tons per sq. ft. of hearth area against 6.66 tons per sq. ft. when the cost of smelting was $1.084.

CANADIAN MINING AND FINANCE CO.'S POWER PLANT AT TIMMINS, ONT.

The Canadian Mining and Finance Co., Ltd., has completed the construction of a central power plant on the south side of Gillies Lake. The building is of steel frame construction, with concrete curtain walls and roof. It is 51 ft. wide x 120 ft. in length, and is designed to accommodate four compressors each of 4,500 cu. ft. of free air per minute capacity. Three compressors are now in commission, with space left for an additional unit. One compressor, designed and built by Fraser & Chalmers, of London, England, is of special design, being fitted with Hoerbiger valves of variable volume gear of the Doerfel type, which automatically adjust the output of the machine to the exact requirements of the demand for air, thus doing away with peak loads, and thereby reducing the cost of power which is purchased upon a basis of peak loads. The cylinders are 22½″ x 38″ x 30″ stroke. The speed is 125 r.p.m. This machine has a complete range of capacity from zero to full load, automatically controlled by suitable governor gear. The other two compressors were designed and built by the Nordberg Manufacturing Company of Milwaukee, Wis. They are designed to run at full load continuously, and have no variable volume gear, the cylinders are 22″ x 37″ x 31″ stroke. The valves are Corless and the speed is 125 r.p.m. These compressors possess the unique advantage of being reversible; thus in the event of an interruption to the supply of electric power they may be operated as steam engines and their motors may be driven as generators of electric power. The supply of steam for this purpose can be obtained from a battery of four Wickes vertical water tube boilers, each having 4,000 sq. ft. of heating surface and connected through suitable breeching to an induced draft fan which enables the boilers to be run at a high overload during such time as the compressor plant is being used for ordinary steam driven electric power plant.

In addition to the usual intercooler and compressor equipment with a Fraser & Chalmers surface cooler, each having 1,100 sq. ft. of cooling surface and so designed that the tubes may be pulled out of the cooler shell for cleaning.

The boiler house is built on the east end of the compressor building and is of the same type of construction. It accommodates the electrically driven pumps for mill water. A concrete intake and suction well has been built to insure a liberal supply of clean water at all seasons of the year.—A. A. Cole.

1915 PROMISES GOOD MINERAL OUTPUT FOR UNITED STATES

"The mid-year finds the mineral industries of the United States generally prosperous and enjoying a revival of active development." With this statement the Director of the United States Geological Survey opens an official review of mining conditions as reported to him by the Government geologists and statisticians working on this subject. "This revival is particularly true of some of the metals for which increased demands have been noted during the past six months. This country has been first thrown upon its own resources for mineral products required and next, given the opportunity to supply the needs of foreign countries who have offered us their trade. Comparative freedom from foreign competition and, in some important cases, increase of foreign markets have stimulated production and a general mining advance has set in."

Summarizing the special reports at hand, Director Smith continues his review:

The six months' record in iron is reassuring in that hopes at the beginning of the year have been realized. Ore shipments from the Lake Superior mines have begun well, May, 1915, showing a 30 per cent. increase over May, 1914. The pig iron output is also promising in its steady increase month by month, so that a reasonable prophecy is for a greater total pig iron production for 1915 than for last year. Enlargement and extensions at the iron and steel plants furnish unmistakable evidence of returning business confidence.

The half-year period just completed has witnessed great changes in the copper industry and in every particular the improvement has been notable. Prices, output, and wages have shown an upward trend, and prosperity is the word in the copper districts of the United States.

The demand for spelter and lead, with the present high prices, have given a double impetus to mining in the zinc-lead districts. In the Joplin region old mines are being reopened, new shafts are being sunk, and prospecting is most active. Smelters are pushed to capacity operation. The six months' period has been altogether favorable for zinc mines and smelters, and the June advance in the price of lead makes the outlook bright for all lead mining.

In the minor metals, the first American mine to be extensively operated for molybdenite has been opened in Colorado; a tin smelter is reported as being built in New Jersey; and the Colorado tungsten mines are working full handed on full time; an antimony smelter in California has resumed operations, and a new one has been erected in the same State to work California ores; and antimony ores have been shipped from Nevada and Alaska. The demand for quicksilver has increased with the result that the California, Nevada, and Texas producers are expected to work at top capacity.

An unusual feature affecting coal mining has been the loss of bunker trade at the Atlantic ports, which is only partially offset by increasing exports. Reports from the West, on the other hand, show an increase in coal production over last year, and in the East the coke output has increased considerably of late, thus showing at last the effect of the recent activity in iron and other metals.

The petroleum production for the six months just closed is believed to exceed that for the corresponding period last year. Unfortunately for the producers, this increase has not been in response to a demand expressed in higher prices. On the contrary the persistent flood of oil from the Oklahoma fields and from the new pools in Louisiana and Texas has prevented any permanent advance in price.

Reports from the Survey's western offices are, in the main, optimistic. Colorado already shows an increase in gold output over the same period in normal years, and while the six months has shown no increase in tonnage for other ores, there has been a large increase in value, and the present high prices give the promise of increased mining activity during the rest of the year. Utah is expected to reach a record output and Nevada mines are being operated at usual capacity, with new activity on the old Comstock. The lead and silver production of Idaho has only recently been stimulated, but a large increase in zinc output has already been shown. In Montana, the copper mines have about reached normal condition, the zinc production already shows a notable increase, and the gold output will be larger. New Mexico reports increases in gold, silver, and zinc, while lead production has fallen off. The six months' output of copper in New Mexico was probably equal to one-half last year's total output, so that there is good expectation of a better total for the year. Arizona, as a copper State, has shown the usual improvement during the six months, while the gold mines promise a record-breaking year. No large increase in Arizona's output of lead or zinc is expected in 1915 over other years. In California some gain in gold yield is reported and copper conditions are much improved over last year. Oregon shows a slight increase in gold output; while in Alaska the outlook is good for increased output of copper as well as gold. More Alaska mines are on a producing basis this year and more dredges are in operation.

Shareholders in the Canadian Goldfields Syndicate, which owned mineral claims in British Columbia and 4,270 shares in the Consolidated Mining and Smelting Co. of Canada, Ltd., will shortly receive a final dividend. The Consolidated shares have been distributed among syndicate shareholders as far as has been practicable, and a small lot left over has been sold, the proceeds of which sale form the final realizable asset available for distribution. Years ago the syndicate sold a group of mineral claims adjoining the St. Eugene group at Moyie, East Kootenay, to the St. Eugene Mining Co., and received shares in that company as part consideration. Later, when the St. Eugene was included in the Consolidated merger, the syndicate received 4,270 shares of the larger company, and so that time whenever the Consolidated Co. paid a dividend, the Canadian Goldfields made a proportionate distribution.

The steamer Victoria, which arrived at Seattle, Washington, from Nome, Alaska, on June 24, took from the North to banks and the United States Assay Office in that city $570,000 in gold from Fairbanks, Iditarod, Ruby, Innoko, Nome and other Alaskan mining fields. Her cargo also included 160 tons of antimony ore from Fairbanks district consigned to San Francisco.

A press despatch published in Edmonton, Alberta, was to the effect that G. F. Cunningham, manager of a colliery at Rosenroll, twelve miles east of Camrose, in that Province, had been drowned on June 22, in Driedmeat lake by the upsetting of a boat from which he was fishing. The deceased was a married man, having a wife and four children at present in Scotland. His parents live in Missouri.

U. S. IRON OUTLOOK BETTER

In a Geological Survey mid-year statement, E. F. Burchard thus reviews the six months trend of the iron industry:

At the close of 1914 it was generally believed that conditions in the iron industry had reached about as low an ebb as was possible and that a reaction must soon begin. Aside from this feeling, however, the prospects at the beginning of 1915 seemed fairer than they had been for many months, although it was realized that many restraining influences would likely continue to operate well into the year.

A glance over the course of the iron industry during the first half of 1915 is at least reassuring, for it indicates that the moderate hopes entertained at the beginning of the year have been fairly well realized. The bginning of 1915 found the lower lake docks and the blast furnaces dependent on lake ores, well stocked with ore, for which there was little demand, yet the mines were equipped to supply more than has ever been required. Precedents generally pointed to an increase in output of ore in 1915, for, with only a few exceptions, there has been a large output of iron ore each year following a year of declining production. The iron mining season has begun auspiciously for the Lake Superior district, for in the month of May, 1915, the shipments were 5,012,357 long tons, compared with 3,852,063 long tons in the corresponding month in 1914, according to the Iron Age, an increase of 1,160,294 tons, or more than 30 per cent.

As to pig iron output there has been a steadily increasing production for each of the first five months of 1915. This contrasts most favorably with the monthly output in 1914, which reached its maximum in March and then trended steadily downward to the end of the year. The production in May, 1915, while not quite reaching that of March, 1914, was about 8 per cent greater than that of May, 1914, and all indications now point to an increased total output of pig iron in 1915.

Prices of Bessemer and basic pig at Pittsburg in June, 1915, showed an advance of 5 to 15 cents a ton over those of May to March, 1915, but they were about 30 cents a ton lower than prices of those grades in June, 1914. Prices of No. 2 foundry at Pittsburg have remained practically stationary this year and are about 1 cents a ton lower than in June, 1914, while the price of Southern No. 2 at Birmingham has declined 25 cents a ton within the last month, and is 95 cents lower than in June, 1914. Pig iron prices, therefore, are not particularly consoling at present.

Among the indications of returning confidence, however, is the gradual resumption in 1915 of much construction work at iron and steel plants that had been abruptly stopped at the outbreak of the European war, as well as the beginning of considerable new work. Important extensions at the plants of the Bethlehem Steel Company have been resumed, important new or resumed operations of the U. S. Steel Corporation are under way at the Homestead, Newcastle, Sharon, Gary, Edgar Thomson, and Duluth plants; a benzol recovery plant is being constructed at Fairfield, Ala., and a plant for the production of phosphate fertilizer from basic open-hearth slag at Eutaw, Ala. The construction of benzol recovery plants is especially active at present. Besides those already mentioned plants are being erected by the Thomas A. Edison Co., at Woodward, Ala., the Northwestern Iron Company at St. Louis, Mo., and the Republic Iron and Steel Company at Youngstown, Ohio.

One American industry, which receives large quantities of iron and steel, for which the future appears particularly bright just now, is that of shipbuilding. The great destruction of ships in the war, coupled with the inability of European builders to replace them, on account of the high prices of steel and of labor, and also because practically all European shipyards are busy in naval construction work, has caused a flood of orders to be poured into American shipyards, especially in the East. It is probable, therefore, that with the work now in hand and in sight, American shipbuilders will have all the business they can handle for several years.

The general outlook for the latter half of 1915 is better than that at the beginning of the year, yet in the face of considerable enforced idleness, especially in southern iron and steel centres, the situation must necessarily show very marked improvement before it can be regarded as satisfactory.

THE CHIEF INSPECTOR OF MINES, B.C.

In the Canadian Mining Journal of June 15 there was printed a letter from Mr. E. Jacobs, of Victoria, B.C., relative to what he characterized as unjustifiable attacks that had been made in the public press of the coast cities of Victoria and Vancouver on Mr. Thos. Graham, chief inspector of mines for British Columbia. On July 1 the Daily Herald, Nanaimo, Vancouver island, B.C., published the following:

"We, the undersigned, the underground employees of the Western Fuel Company, desire to place ourselves on record as follows:

"Whereas certain grave allegations have been publicly made against the ability and integrity of Mr. Thomas Graham, chief inspector of mines in this province, on the strength of which certain labor organizations have demanded his retirement;

"That, therefore, we declare these allegations to be untrue, beside being uncalled for, and denounce such tactics as in the last degree unfair and against the best interests of the miners of this province.

"We also wish to express our unbounded confidence in Chief Inspector Graham's ability, and, from long experience, our faith in his practical knowledge in all matters of safety underground. Above all we cannot too strongly emphasize the fact of his standing in the community as a man of sterling qualities and irreproachable integrity, and we especially deplore the base attacks that have been lately made against a man of such exceptionally high principle.

"We also desire to express generally our confidence in the staff of mine inspectors under Mr. Graham, knowing their efficiency and reliability."

The Herald's comments on the foregoing follow:

The above memorial has this week been forwarded to the Acting Minister of Mines at Victoria. There is little explanation necessary. The memorial was an entirely voluntary affair, inspired, in the minds of the men who got it up, by the attacks that have been made upon Chief Inspector Graham. It was signed by practically all the men employed underground by the Western Fuel Co. [illegible] than a dozen out of the whole number refusing to sign their names. He value lies in the voluntary character and in the general unanimity with which it was signed. It is a common enough thing for public servants to be made the butt of political factions, and numbers in the world it is the price [illegible] with greater bitterness and less decency than in British Columbia. It is not necessary for the Farmers and almost public servants to be defended in a public memorial, and it is all the more gratifying which it does occur. The term of public service is more to be relied on than the assurances of swaying politicians.

PERSONAL AND GENERAL

Mr. W. Munroe Archibald, of the Consolidated Mining and Smelting Company's mining engineering staff, has returned to Trail, B.C., from a trip to Chicago, Ill.

Mr. A. J. Beaudette, of Vancouver, B.C., is now retained by the Pacific Great Eastern Railway Co., to advise and assist prospectors relative to the development of mining property along the company's railway line from Vancouver through Lillooet and Cariboo districts to Prince George.

Mr. C. Victor Brennan, of the Utah Consolidated Mining Company's Highland Boy mine, Bingham, Utah, has been examining mining properties in Kootenay district, British Columbia.

Mr. R. W. Brock, dean of the College of Applied Science, University of British Columbia, returned to Vancouver last month from a trip to eastern parts.

Mr. Alfred H. Brooks, of Washington, D.C., Geologist in Charge of Alaskan Mineral Resources, U. S. Geological Survey, is expected to proceed to Alaska during July. During recent months twelve U. S. Geological Survey field parties passed through Seattle, Washington, on their way to different parts of Alaska to enter on their season's work in that country.

Mr. E. A. Collins, inspector of mines, Ontario Bureau of Mines, was one of the speakers at the smoker and banquet held at St. Louis, Missouri, on June 9, in connection with the eighth annual meeting of the Mine Inspectors' Institute of the United States of America. Mr. Thomas Graham, of Victoria, chief inspector of mines for British Columbia, has since that date been advised of his election as first vice-president of the institute, of which he was a third vice-president last year.

Mr. P. E. Crane is now superintendent at the British Columbia Copper Company's Mother Lode mine, near Greenwood, Boundary district, B.C., at which operations have been resumed after suspension of work since last August.

Mr. Howard W. DuBois, of DuBois, Mixer & Armas, consulting mining engineers, of Philadelphia, is in Alaska.

Mr. Peter MacLaren is at Gowganda.

Mr. A. R. Whitman, lately geologist of the McIntyre Company, has been engaged by the Peterson Lake Mining Company, to examine the property.

Mr. F. M. Connell is at Goodfish Lake.

Mr. J. A. Holmes and the members of the firm of Smith and Travers, are operating a nickel-copper mine in the Sudbury district.

Mr. Chas. Spearman has returned to Haileybury.

Mr. A. G. Burrows and Mr. Percy Hopkins are at Timmins.

Mr. Mark Harris was at Haileybury last week.

Mr. Stewart Thorne has recovered from his recent illness and is again at Cobalt.

Dr. F. W. McNair, president of the Michigan College of Mines, has returned to Houghton after a visit to Cobalt, Porcupine and Sudbury. At each camp he was entertained by graduates of the College.

Mr. G. S. Eldridge is now conducting the assay business formerly held by Mr. Noble W. Pirrie, who three months ago went to England to engage in military service.

Mr. George Watkin Evans, coal mining engineer, has returned to Seattle, Washington, from a professional trip to New York City.

Mr. R. D. Fetherstonhaugh, of Vancouver, B.C., was at Prince George, on the Grand Trunk Pacific railway on June 19, in company with several men from Edmonton, Alberta, en route to the headwaters of Peace river, and thence to Fond du Lac, northeast of Edmonton. A press despatch stated that at Mt. Selwyn, near the confluence of the Parsnip and Finlay rivers, a promising quartz showing would be examined, while at Fond du Lac reported occurrences of ore containing silver and cobalt were to be investigated.

Mr. R. W. M. Hunter, of Victoria, B.C., has been examining mineral claims in the neighborhood of Great Central lake, Vancouver island.

Mr. W. H. Lanagan left San Francisco, California, last month to visit British Columbia.

Col. R. G. Edwards Leckie has been honored by the King with the C. M. G. decoration, in acknowledgment of distinguished service on the battlefield in Europe.

Mr. Lewis A. Levensaler, of Tacoma, Washington, who last month was in Ashcroft mining division of British Columbia, has since proceeded to Alaska to investigate conditions at some of the Guggenheim mines in that country.

Mr. J. F. Longworth, who, following the suspension of operations last summer at the British Columbia Copper Co.'s Napoleon mine near Boyds, Washington, engaged in mining in Republic camp, in the same State, is now assistant superintendent at the company's copper smelting works at Greenwood, Boundary district of British Columbia.

Mr. Dudley Mitchell, of Victoria, B.C., Provincial Instructor in First Aid to the Injured, after having given instruction to coal miners at Cumberland, Vancouver Island, in the use of oxygen breathing rescue apparatus, proceeded to the Crowsnest district. He will go thence to Phoenix, Boundary district, to reorganize First Aid instruction classes there, and then to Rossland to attend a demonstration of First Aid work by local miners on the occasion of the meeting there on July 15 of the Western Branch of the Canadian Mining Institute.

Mr. F. S. Norcross, Jr., superintendent of mines for the British Columbia Copper Co., now makes Copper Mountain, Similkameen, his headquarters, the company having in progress important development work on copper claims there.

Mr. M. E. Purcell, superintendent of the Consolidated Mining and Smelting Company's Centre Star-War Eagle group of mines at Rossland, has returned from a visit to the Panama-Pacific International Exposition at San Francisco, California.

Mr. R. W. Racey, of the Consolidated Mining and Smelting Co.'s mining engineering staff, Rossland, B. C., was married on June 24 at Summerland, Okanagan, B.C., to Miss Olga Watson.

Mr. Emil F. Voigt has returned to Voigt's camp, near Princeton, Similkameen, B.C., from a visit to Portland, Oregon.

Mr. W. R. Wilson, of Fernie, B.C., general manager for the Crow's Nest Pass Coal Co., has been in Victoria and other places on Vancouver Island lately.

The Roberts and Schaefer Company, engineers and contractors, Chicago, have just been awarded a contract by the Cherry Tree Coal Company, which is owned by Peale, Peacock & Kerr, for the building of a new "Marcus" Patent Coal Tipple, complete with screening and picking facilities, for installation at Mine No. 15, St Benedict, Pa. The George's Creek Coal Company have also given the Roberts and Schaefer Company an order for a mechanical equipment for a four-track, frame constructed "Marcus" Patent Coal Tipple, using "Rand" Shaker Loading Boom, for installation at Ethel, W. Va.

SPECIAL CORRESPONDENCE

BRITISH COLUMBIA

Evidence of the gradual enlargement of the field of mining operations in Kootenay and Boundary districts of British Columbia is found in the recent inclusion in the list of mines shipping ore to the Consolidated Mining and Smelting Co.'s smelting works at Trail of several that had not previously in this year shipped any ore. In some instances there had not been any production for a year or more. While the quantities of ore shipped recently by these mines are not large, the fact that they are again being operated is gratifying, indicating, as it does, progress in the mining industry of the districts chiefly concerned. The Monarch, near Field, Northeast Kootenay; the Cork and the Silver Hoard, in Ainsworth mining division; the Wonderful, near Sandon, Slocan; the Nettie L., near Ferguson, Lardeau district; the Carmi, Rob Roy and Sally, up the west fork of Kettle river, Boundary district; and the Iron Mask, near Kamloops, appear on the June lists of ore receipts at Trail. In addition, work has been resumed on several properties that had long lain idle. Prominent among these is the Galena Farm group, situated near Silverton, Slocan lake, which about nineteen years ago was acquired by English investors who organized the Galena Mines Company, Ltd., of London. A steam power plant was put in and development work—shaft-sinking and other underground work—was undertaken. However conditions for operating the mine became unfavorable, so work was suspended and there has since been a long period of inactivity, until now much energy is being displayed with the object of determining the value of the property as an ore producer.

Some air bubbles pricked.—Much fiction relative to mining in the province is from time to time published on the coast. One enthusiast was lately quoted in a prominent daily newspaper as having first told of the certainty that a property (not yet a producer) is "a big mine," and then characterized the Hedley mine as "the only other great gold mine in the province." Now, not with the slightest intention to belittle the Hedley gold mine, which in recent years has produced nearly 40,000 oz. of gold a year, but rather to make a statement of fact, the following figures are submitted. In 1914 Rossland mines—the Centre Star group, Le Ro, and Josie group—produced about 138,000 oz. of gold against nearly 137,000 oz. in 1913 and 132,000 in 1912. In 1912 Boundary district mines produced in addition to the output of the Hedley mine, nearly 68,000 oz. of gold, in 1913 about 71,000 oz., and in 1914, which was a short operating year, owing to the war having compelled suspension during the greater part of the latter half of the year, about 45,000 oz. These figures show that of what the irresponsible talker designates "great gold mines" there are several in the province beside that at Hedley. Then a notorious romancer, whose yarns [illegible] published, was quoted in the same issue of the newspaper referred to, as having said: "The output of gold from the Rossland district alone is at the rate of $5,000,000 a year. . . . . Over 40,000 tons of lead a year is now being mined. The production is expected to be increased to 60,000 before long. More than 100,000 tons of zinc could be produced if only there were plant to handle the mineral." Official records show that in ten years—1905-1914—the total value of the gold produced in Trail Creek mining division, in which the Rossland mines are situated, was $25,441,546, or an average of $2,544,154 a year. The highest total for any individual year was $2,941,630 in 1908; the total for 1914 was $2,864,201, and this with the bigger mines having worked full time. It is true that the total quantity of ore shipped to Trail during six months to July 1 of this year is about 173,000 tons against 128,000 tons for the corresponding period of last year, yet the increase of about one-third thus shown, even if maintained throughout the second half of the year, cannot be expected to result in an output of gold being made to a total value of $4,000,000, not to say the $5,000,000 indicated by the romancer quoted. Again, the highest yearly output of lead made by the province in ten years was in 1905, with a recorded production of 28,000 tons, which quantity was nearly reached in 1913, but other years of that period ranged down to a minimum of 13,436 tons in 1911. It would seem that only one possessed with a vivid imagination would venture to guess that there is any probability of a total output of 40,000 tons being reached this year, while 60,000 tons is only a remote possibility at present. As to a production of 100,000 tons of zinc a year—that seems like the wildest kind of a guess, having in view the comparatively limited known zinc resources of the province. The publication of such fictitious figures cannot do any good at all to the mining industry of British Columbia nor to any newspaper printing them; rather does it warrant the oft-heard remark, "Oh, that is only newspaper talk!"

Zinc in British Columbia.—At this time, when there is a general tendency to over-estimate the zinc resources of British Columbia, it is well to take into account the conclusions of those who have given the subject close and intelligent attention. In 1906 the Mines Branch of the Department of the Interior published the "Report of the Commission appointed to investigate the Zinc Resources of British Columbia and the conditions affecting their exploitation." The work of that commission was directed by Mr. W. R. Ingalls, of New York, and he had the assistance in the field of Mr. Philip Argall, of Denver, Colorado, and others. In the course of his report Mr. Ingalls observed: "I have already estimated that Ainsworth and the Slocan are each capable of producing [illegible] milling facilities have been provided) about 30,000 tons of blende per annum of an average (nominal) zinc content of 50 per cent. This would correspond to a spelter production of upward of 12,000 tons, or approximately [illegible] the present consumption of the Dominion. . . . . As previously pointed out, the immediately available zinc resources of British Columbia are those of Ainsworth and the Slocan." Of course, these observations are in sharp contrast to the airy views of some newspaper contributors, but then Mr. Ingalls was in the habit of stating [illegible] makes all the difference in what is written.

Dividends.—Dividends for the [illegible] declared by mining companies operating in British Columbia total $130,296, as compared with $170,976 for the first quarter of the year. The total for the half year is therefore [illegible] eral companies concerned and their respective amounts are shown in the following table:

Company	First quarter.	Second quarter.
Consolidated M. and S. Co	$116,098	$116,098
Granby Con. M. S. and P. Co. ..	.....	224,978
Hedley Gold Mining Co.	60,000	60,000
Le Roi. No. 2, Ltd.	.....	29.220
Totals.	$176,098	$430,296

With the exception of the Le Roi No. 2, Ltd., the companies included in the foregoing statement paid similar amounts as dividends in the first six months of 1914. The last-mentioned company was not on last year's dividend list at all. On the other hand, the Standard Silver-Lead Co., which during the first half of 1914 distributed profits to a total of $350,000, is not yet on this year's list, though it may be expected to resume dividend payments shortly.

Consolidated Mining and Smelting Co.'s Smelter at Trail, B.C.

Lead Refinery, Trail, B.C.

Surf Inlet.—Announcement has been made that the Tonopah-Belmont Development Co. has cut the vein at depth on the property of the Surf Inlet Gold Mines, Ltd., on Princess Royal island, which it has been exploring under option of purchase, in connection with which a six months' extension of the term of the bond was granted a few weeks ago. The crosscut adit intersected the vein at more than 2,500 ft. from the portal of this exploratory tunnel. The depth below the old workings is approximately 700 ft., and it is stated that the vein where cut at depth is 9 ft. wide between walls. The average gold value is reported to be about $8 a ton. Extensive development of the vein is now to be undertaken. It is confidently expected that the bonding company will take up its option on the property and proceed ere long to make provision for mining and milling the ore, so as to place the mine on a regular producing basis.

Britannia.—Figures showing the results of operations at the Britannia mine and concentrating mill on Howe sound, Vancouver mining division, are now available as follows: Total receipts for the last fiscal year, $1,195,161.78; expenditures, $1,169,530.58; balance, net profit $25,631.20. Included in the expenditures were the following items properly chargeable to capital account: Construction, $249.101.35; equipment, $162,032.22, so that the actual profit on the year's operations was $436.764.77. Information relative to production given out at the beginning of this year was that there had been mined 239.174 tons of ore and that shipments to the smeltery at Tacoma, Washington, of crude ore and mill concentrate had totaled 38,750 tons, the approximate gross metal contents of which were 250 oz. gold, 70,000 oz. silver and 12,000,000 lb. copper. The annual report shows that of a total of 2,945,680 tons of known ore there is broken in the stopes 479,638 tons. Good progress has been made toward completion of the first 1,000 ton unit of the new concentrating mill, which is to eventually have a capacity of 2,000 tons, and of the transportation system between mine and mill, this consisting of a 3 ft. gauge track with 45 lb. steel the full length of the crosscut adit driven 4,336 ft. into Britannia mountain and thence from the portal of the adit three and a half miles to the top of a 5,500 ft. incline, having an average grade of approximately 30 per cent., down to the concentrating mill, the incline being double tracked with 56 lb. steel rails, over which 20 ton skips will be operated by a winding engine at the head of the incline.

COBALT, GOWGANDA, SOUTH LORRAIN

The situation in the Cobalt camp continues to be one of diminished profits. The price of silver during the second week of July was the lowest ever experienced in the history of the Cobalt camp. This and the fact that

everything used by the mining companies remains as dear and most materials much higher makes the situation not very satisfactory. There is, of course, a disposition on the part of all the companies to direct their energies to store bullion as much as possible beyond the point where dividends and current expenses have been taken care of. The second quarter of the year will probably show a decrease in production at least as great as the first quarter of the year.

New Finds.—This is in spite of the fact that several valuable new finds have been made. For the past six weeks the Mining Corporation of Canada has been working a rich vein on the City of Cobalt. The vein is in several places seven inches wide, of very high-grade ore. It is heading directly for the Cobalt Lake, which is also included in the Mining Corporation of Canada and therefore can be worked as far as it runs. The discovery seems important not only to the City of Cobalt but to the Cobalt Lake Company. On the surface no veins have ever been found, prospecting always being difficult, as it has to take place in the very centre of the town of Cobalt. The new discovery does therefore add materially to the reserves of known ore in the Cobalt camp. The pumping out of Cobalt Lake has been completed to its first stage. The lake has been dewatered with the exception of a shallow pool around the pumps themselves. Contrary to the general expectation there is little or no odor from the bottom of the lake. Most of the bottom of the lake is covered with the sands and slimes from the concentrators which have for years poured tailings into the lake.

New Cyanide Plant—The practice of cyaniding the slimes at the Cobalt Reduction Plant has now reached the stage where it is possible to give figures. It seems most likely from these figures that the saving in extraction will more than repay the company for the outlay in plant within a very short time. Over 300 tons of Cobalt Townsite and City of Cobalt ore are being treated in the Cobalt Reduction plant. It is the slimes alone that are affected by the new process. The mill heads run from 25 to 30 oz. to the ton after hand picking, but before jigging. After jigging they will run 18 to 22 oz.; after crushing and classifying the 140 tons of slimes go to the cyanide plant. By the new process a further extraction of 20 per cent. is made on the slimes and the smelting charges of about 1.10 per ton on the slime concentrates is saved because the precipitate is now mined on the property and shipped as bullion.

Foster—The lease of the Foster mine to the Glen Lake-Cobalt mines has been extended for a further five years. The original lease was for five years so that the Glen Lake now has the lease until 1922. The royalty paid on low-grade ore was also cut down from 25 net to 15 net. The Glen Lake has operated a crosscut for 850 ft. from the shaft of the Foster and Glen Lake. The objective of the management is to crosscut veins in the conglomerate. The crosscut should soon be in that formation.

Currie.—On the Currie mine in South Lorrain a very rich find is now being worked. It is on the 230-ft. level about 6 in. of cobalt and silver which will run about 7,000 oz. in silver. It has been raised on and holds good for 40 ft. It is very strong in the bottom of the drift and the vein appears quite promising.

Wettlaufer.—There was a possibility that the Wettlaufer might be worked again, but the negotiations for the renewing of operations fell through.

Gowganda.—Conditions in the Gowganda camp show little improvement. That this is largely due to the wretched transportation conditions, cannot be denied. The Gowganda road from Elk Lake is now in a condition which renders travelling most difficult and tedious. The heavy rains of this spring have washed away the sand and the road is little better than a mountain trail. Leaving the Miller Lake-O'Brien mine in the afternoon at three o'clock an official of that company did not arrive in Elk Lake until ten o'clock that night. Under present conditions no one will go into the camp unless they have the most urgent business.

The Miller Lake-O'Brien is now running both mill and mine full time again; both turbines of the power plant are working and 500 horse power is available. The mine is being worked for the 24 hours. The mill is being run during the day time only. Now that more power is available work has again been started on the Millerett.

The Montreal Syndicate controlling the Powerful Mining Company is again working a small gang of men at Calcite Lake. The option which the Oliver Mining Company had on this property expired, and the Powerful Company again decided to do some work themselves.

Temiskaming.—No stoping of high-grade ore is in practice in the Temiskaming mine, but two hammer drills are engaged in breaking down milling rock. A new vein or the extension of an old vein found in the back of an old stope on the 400-ft. level is still furnishing very good ore. It is six inches wide in the face. The ore sent to the mill is running much higher than usual.

Last month from the mill alone there was produced between 60,000 and 70,000 oz. in silver. There is on hand and ready to ship a considerable amount of high grade ore.

Nipissing.—The production of the Nipissing for June showed a gain of about $11,000 in comparison with last month. Ore valued at $186,791 was mined in June. Considerable success was obtained in opening up new ore on several branch veins at the fourth level of the Meyer. New development on one of these raises shows the vein to be two inches wide, of 2,000 oz. ore, 47 ft. above the fourth level. The raise is also 82 ft. on the branch vein. For the last 50 ft. the vein averaged two inches and ran 2,500 oz. Two drills are running on veins discovered on the shore of Peterson Lake last week. The best of these are in the Keewatin formation. The best is about 50 ft. long. It will average one to two inches in width and runs about 3000 oz. to the ton. The high grade mill treated 180 tons and shipped 764,559 fine oz. Of the total production 101,842 was from low grade ore and 84,949 from high grade.

Bullion shipments from the Cobalt camp for the year to date amount to 4,561,134 oz.; of this, Nipissing has contributed from its own and ore bought from other mines in the camp 3,339,103 oz. A factor of the shipment is the reopening of the Silver Leaf. They have now made two considerable shipments in bullion refined from low-grade ore; in addition to this there is on hand a considerable quantity of high grade.

Peterson Lake Mining Company has retained the services of Mr. A. R. Whitman in order that they may have his experience as to the geology of their section. Mr. Whitman was very successful in locating the ore bodies on the fault plains on the McKinley mine.

Another old Cobalt property has been leased on the royalty basis. Mr. H. V. Nicholls is now operating the Silver Queen mine, upon which the Cobalt Mining had a lease for two years, but which was allowed to lapse.

Work on the Right-of-Way, adjoining the Silver Queen mine revealed possibilities to pick up extensions of orebodies and the lease was taken accordingly.

PORCUPINE AND KIRKLAND LAKE

Deloro.—There is apparent in the Porcupine camp a steady increase in the range of operations. Discovery on the Wright claims in Deloro Township has led to a revival of interest in that section.

The intention of Mr. Taylor to work the Imperial has also led to a better disposition towards that part of Deloro in which the Imperial is situated. Among the large operating mines themselves there has also been a general disposition to steadily increase the size of their operations.

Hollinger is steadily raising tonnage at its mill. Owing to the fact that costs are now down to $3.50 a ton, it is possible to include much ore that it had previously left in the mine as too low to treat. This has naturally kept down the grade of ore until it now stands at about $9.50. Seventy stamps are available for the treatment of ore, but the mine is now so much ahead of mill conditions that it is certain that within a fairly short period it will be necessary for the Hollinger to take over the 30 stamps now being used by the Acme. Whether the Acme will build a separate mill or will add an extension to the Hollinger mill to treat their ore is a question which has not yet been decided. Owing to the large increase in the operations at the Hollinger it is now absolutely necessary to build a new office. This will be erected within a very short time. Tenders will soon be let.

An experiment in order to use iron balls in tube mills has received a check owing to the fact that the wear and tear caused by the balls on the liners is at present too excessive. An order has been given for a set of steel liners, and these will be used in order to see if thy will meet the difficulty.

Gibson.—The development on the Gibson claims at Goodfish lake is quite satisfactory. The shaft is now down to the 100-ft. level on ore. Below the 10-ft. sump several additional stringers have been cut, and it now appears that a grade of from $15 to $18 can be obtained across 6 or 7 ft. Drifting on the vein on the 100-ft. level will be commenced at once. Mr. C. E. Foster, who has a third interest in the Costello claim, is also preparing to develop that property. A road has been cut from the Tough-Oakes and supplies are now being taken in along this route.

The Tough-Oakes had a successful month in June. The grade was very high and the extraction has been raised to about 95 per cent. The improvement in extraction is largely due to the much greater efficiency in amalgamation on the plates. Mr. Randall uses cocoanut matting, which proves to be a very successful trapper of the coarse gold which defied amalgamation and which passed through the decantation system without being dissolved. The ore in the west drift on the 300-ft. level is very rich indeed. Beyond the fault on the same level the vein has been picked up again. It is rich, but by no means as rich on the east side of the fault. The shaft will be put down to the 400-ft. level with all dispatch.

The Teck-Hughes at Kirkland Lake has been dewatered and resampled. This is being done by a Cobalt company and it is not known yet whether they will decide to go ahead and work it or not.

The Hollinger Reserve in Ogden township is under option to the Dominion Reduction Company, now engaged in sampling it. The Hayden claims in the same district are also likely to be active this summer, as the owners will install a plant and resume work on the known veins.

Lake Shore.—An improvement is apparent in the Lake Shore mine, Kirkland lake. Fifty ft. from the shaft on the 200-ft. level the sludge from the diamond drill will average $48 a ton over a width of three feet. The ore in the west drift on the 100 ft. level has remained of very good grade. A crosscut will now be run from the 200-ft. level to pick up the main vein at the point where it was cut by the diamond drill.

The McIntyre Mining Company has decided to issue a regular statement of production either monthly or quarterly. In the month of June the production both in tonnage and bullion output was very satisfactory. Development at the No. 5 shaft also tends to bear out the optimism of the management. The vein that they cut with the diamond drill at about the 300-ft. level has now been struck in a crosscut and is proving quite satisfactory.

Moneta.—According to the annual report of the Moneta Porcupine Mining Company, it is not probable that that company will resume operations very shortly. It was debated whether it might not be advisable to sell the 453,900 shares still left in the treasury, but Sir Henry Pellatt, who is at the head of the company, did not deem it advisable to do so just at present. No doubt later on the stock will be issued in order to provide money for further development. On March 31 there had been expended a total of $86,785, and there was a balance of $1,213 in the bank. Quite an extensive sale of town lots netted the company nearly $90,000.

North Thompson.—Good progress is being made with the new shaft and other improvements at the North Thompson. A 125 horse power boiler has been ordered which will increase the available horse power on the property to 225. The three compartment shaft is now almost completed to the 200-ft. level and the head frame is finished. There is every indication that the Hurona Belt Company has decided to push development on the North Thompson with much vigor.

While the reorganization meeting of the Porcupine Branch of the Canadian Mining Institute was only sparsely attended it was most successful. The following officials were elected: Charles Williams, chairman; C. H. Poirier, vice-chairman; C. B. Morgan, secretary-treasurer; and Executive Committee, C. A. Randall, R. W. Ennis, H. W. Darling, D. Dorfman, N. Evered, H. Heine, H. Seavelin, J. Houston, A. R. Brown, William Hatch, and J. Church. A most interesting discussion was started by Mr. Dorfman, of the McIntyre, on precipitation. He said that precipitation had been neglected by mill men and he gave facts and figures as the result of his experiment at the McIntyre mine, which provoked a lively surprise and a most interesting discussion. It is felt that the executive elected is most representative and that meetings in Porcupine will be extremely interesting and important to the profession.

Chino Copper Co., which is now speeded up to a production rate of 75,000,000 lb. per year, is claimed to have the lowest cost per pound, 6.4 cents, of all the "porphyry" coppers.

The new Rogers Pass Tunnel of the C. P. R. under the Selkirks in British Columbia, five miles long, is a quarter of a mile longer than the famous Hoosac Tunnel of Massachusetts, begun in 1851, where power rock drills, nitroglycerine, and electric firing were first used in North America.

NEW YORK

It is interesting to note that, when a German high official claimed that a arge proportion of the German soldiers killed in a certain series of battles with the French were killed by American ammunition, the French Government issued a flat statement that it has received no ammunition from the United States. However, if the German soldiers were killed by American ammunition, the sentiment would not be entirely absent from American minds that 'twere well.

Henry Ford, who will not admit anything is impossible until he has failed at it, plans a new blast furnace to make iron for Ford automobiles. He says: "We expect to have our fleet of boats to carry ore and transport machines destined to foreign countries through the Welland Canal."

Anaconda Copper Mining Company, which is succeeding to the status and power of Amalgamated Copper Company, now being dissolved, is reported to be investigating copper prospects in the Andes, and to be directing attention to the feasibility of smelting Bolivian tin ores in the United States, which country consumes 43 per cent. of the world's tin, but mines or smelts scarcely any.

Just as Nova Scotia is increasing coal exports to foreign countries on account of the call for British coal at home, so is the United States increasing coal exports, and it is hoped to develop a legitimate business in selling American coal abroad. The United States is now shipping bituminous coal to Italy, Mexico, Cuba, South America, and is considering a large contract in France.

There is a miner's strike in the Joplin, Missouri, zinc fields.

A street car ride in Juarez, Mexico, costs 10 cent Villa paper money. Ten cents in Villa's money is worth four-tenths of a cent in United States money.

Lake Superior iron-ore shipments are beginning to brisk up a little after an unusually dull period. It is hoped to reach 40,000,000 tons for the season, as compared to about 33,000,000 in 1915 and 50,000,000 in 1913.

Zinc miners are interested in the recent announcement that the United States Steel Corporation would spend two or three millions on a new zinc smelter near Pittsburg, Pa., since in that case the corporation would change from buying spelter for galvanizing iron to buying zinc ores and concentrates. It is reported now that a contract has been made for a supply of Australian ore formerly smelted in Germany and Belgium.

OBITUARY

On June 7 Patrick Clark died in Spokane, Washington, in which city he had had his home for about 28 years. He was one of the best known mine operators in the Northwest, having been engaged in mining in Butte, Montana, Coeur d'Alene district, Idaho; Republic camp, Washington, in various parts of Kootenay and Boundary districts of British Columbia and elsewhere. More than twenty years ago he became interested in Rossland mining properties, first doing development work on the Josie and, after relinquishing his bond on that property, taking the War Eagle under option of purchase. Within a short time of his undertaking the development of the War Eagle he was so successful that on February 1, 1895, a dividend of $32,500 was paid out of profits derived from this mine. Mr. Clark and his associates later sold the War Eagle to the Gooderham-Blackstock syndicate, Toronto. In late years he gave attention to Slocan mines, as well as keeping up his large mining interests in Montana, Idaho, and other parts. During the course of his years of activities in mining he was associated with the late Marcus Daly and former Senator W. A. Clark, both mine operators on a large scale. At the time of his death he was about 65 years of age.

John A. Finch, who died at his summer home at Hayden lake, Idaho, on June 20, aged 61 years, was widely known in the Northwest as a successful mine operator. He had large mining interests in the Coeur d'Alene district for many years, and as well, had long been actively associated with mining in Kootenay district, British Columbia. Among his enterprises was the development of the St. Eugene lead mine in East Kootenay, a considerable interest in which he held years ago at a time when another part owner, James Cronin, was in charge of the mine. With George H. Aylard, he developed the Standard silver-lead mine, situated near Silverton, Slocan lake, B.C., from a mere prospect into a producing mine, which during recent years has paid $1,550,000 in dividends and still has large reserves of ore. His business partner in the well-known Spokane firm of Finch & Campbell died a year or two ago. Both partners were highly esteemed, and were prominent in the commercial and financial life of Spokane, a flourishing city that has benefited greatly by the mining undertakings of a group of men of whom but few are now left.

On July 1, Archibald Dick, for many years, until his retirement about five years ago, senior inspector of mines in British Columbia, died at his home in Nanaimo, Vancouver Island, B.C., after having been on the Pacific coast fifty years. He leaves a widow and eight children, one of whom is Mr. W. J. Dick, of Ottawa, mining engineer to the Commission of Conservation. The late Mr. Dick was about 75 years of age.

Mr. Frederic Keffer and Mr. Henry Johns have formed a partnership, with office at 214 Hutton building, Spokane, for the purpose of conducting a general mining business, particularly as regards the examination, reports upon and the management of mining properties. Mr. Frederic Keffer has for the past seventeen years been associated with the British Columbia Copper Co., Ltd., of Greenwood, B.C., as its general manager through the earlier years of its operations, and afterwards as its consulting engineer and geologist. Mr. Henry Johns has also been associated with the above company for about fifteen years as superintendent of a number of its mines. They have recently severed their connection with the company in order to engage in the present business.

Reports of the discovery near Dawson, Yukon Territory, of platinum-bearing ore have been published in local newspapers. It is stated that one assayer at Dawson as a result of several tests has obtained buttons that he believes are platinum, but has not been prepared to report positively that such is the case. He has sent samples of the ore to several other assayers in various cities and is awaiting their results. Meanwhile a number of quartz locations have been recorded. Apart from these reports, it is known that platinum occurs in gold recovered from streams in the neighborhood of Dawson, but a definite statement has been made by one of the officials that the presence of that mineral was conclusively shown some time ago in determinations made at the Provincial Government Assay Office at Victoria, British Columbia.

MARKETS

SILVER PRICES.

	New York, cents.	London, pence.
June 23	49⅝	23⅛
24	48¾	23 3/16
25	48½	23 1/16
26	48⅝	23 1/16
28	48½	23
29	48	22⅞
30	48	22⅞
July 1	48¼	22 15/16
2	48¼	22 15/16
3	48¼	22 15/16
5	....	22 15/16
6	48	22 15/16
7	47¾	22 11/16
8	47½	22 9/16
9	47⅝	22⅝

STOCK QUOTATIONS.

(Courtesy of J. P. Bickell & Co., Standard Bank Building, Toronto, Ontario.)

July 8, 1915.

New York Curb.

	Bid.	Ask.
Alaska Gold	37.75	38.50
Braden Copper	6.87½	7.00
California Oil	274.00	276.00
Chino Copper	44.50	44.75
Goldfield Cons.	1.37½	1.87½
Green Can.	36.00	38.00
Granby.	52.50	53.00
Inspiration Copper	30.25	30.62½
International Nickel	150.00	152.00
Miami Copper	26.87½	27.12½
Nevada Copper	14.12½	14.37½
Ray Cons. Copper	23.00	23.12½
Standard Oil of N. Y.	183.00	185.00
Standard Oil of N. J.	398.00	400.00
Tonopah Mining	7.12½	7.25
Tonopah Belmont	4.00	4.12½
Tonopah Merger	40.00	41.00
Yukon Gold	2.50	2.75

Porcupine Stocks.

	Bid.	Ask.
Apex.	.03¼	.03⅜
Dome Extension	.12	.12½
Dome Lake	.22½	.23¼
Dome Mines	19.50	19.95
Foley O'Brien	.30	.32
Hollinger.	26.10	26.75
Jupiter.	.08¼	.08¾
McIntyre.	.48	.48¼
Moneta.	.05	.05½
Pearl Lake	.01¼	.01¾
Porcupine Gold	½	⅞
Porcupine Imperial	.05	.05½
Porcupine Crown	.70	.80
Preston East Dome	.02⅞	.03¼
Rea.	.10	.15
P. Vipond	.56	.57
P. Tisdale	.01	.02
West Dome	.06¼	.06½

Cobalt Stocks.

	Bid.	Ask.
Bailey.	.02¼	.02⅜
Beaver.	.29	.30
Buffalo.	.50	.65
Chambers Ferland	.21	.24
Coniagas.	4.87½	5.25
Crown Reserve	.55	.61
Foster.	.03½	.07
Gifford.	.017	.021
Gould.	¼	⅝
Great Northern	.02⅜	.02½
Hudson Bay	.18	.21
Kerr Lake	4.25	4.50
La Rose	.48	.51
McKinley.	.22	.24
Nipissing.	5.60	5.70
Peterson Lake	.22½	.23
Right of Way	.03	.04
Silver Leaf	.02½	.03¼
Teck Hughes	.05½	.06
Temiskaming.	.32½	.33
Trethewey.	...	.10½
Wettlaufer.	.03½	.05
Seneca Superior	...	1.00

TORONTO MARKETS.

July 12, 1915—(Quotations from Canada Metal Co., Toronto)—
- Spelter, 30 cents per lb.
- Lead, 7 cents per lb.
- Tin, 45 cents per lb.
- Antimony, 40 cents per lb.
- Copper casting, 22 cents per lb.
- Electrolytic, 22 cents per lb.
- Ingot brass, yellow, 13c.; red, 15 cents per lb.

July 12, 1915—(Quotations from Elias Rogers Co., Toronto)—
- Coal, anthracite, $7.50 per ton.
- Coal, bituminous, $5.25 per ton.

NEW YORK MARKETS.

July 9, 1915—Connellsville Coke (f.o.b. ovens)—
- Furnace coke, prompt, $1.60 per ton.
- Foundry coke, prompt, $2.00 to $2.40 per ton.

July 9, 1915—Tin, straits, 38.95 cents.
- Copper, Prime Lake, 19.62½ to 19.87½ cents.
- Electrolytic copper, 19.37½ to 19.62½ cents.
- Copper wire, 21.00 to 21.50 cents.
- Lead, 5.75 cents.
- Spelter, 22.50 to 23.00 cents.
- Sheet zinc (f.o.b. smelter), 27.00 cents.
- Aluminum, 32.00 to 33.00 cents.
- Nickel, 50.00 cents.
- Platinum, soft, $40.00 per ounce.
- Platinum, hard, 10 per cent., $42.00 per ounce.
- Bismuth, $2.75 to $3.00 per lb.
- Quicksilver, $92.00 to $95.00 per 75-lb. flask.

Mr. Cadwallader Evans has resigned from the position of general manager of the Acadia Coal Company and has been succeeded by Mr. Hector Prudhomme of Montreal, who has for some time been the secretary-treasurer of the company. Mr. Evans has left for California, where he will join Mrs. Evans, and expects to take a well-earned rest before he again takes up mining work.

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

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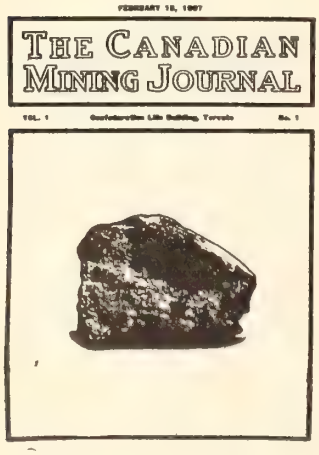

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REPORTS RECENTLY ISSUED:

CANADA
Memoir 59. Coal Fields and Coal Resources of Canada, by D. B. Dowling.
Summary Report of the Geological Survey for the year 1914.
NEW BRUNSWICK and NOVA SCOTIA
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Memoir 60. Arisaig-Antigonish District, Nova Scotia, by M. Y. Williams.
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MAPS RECENTLY ISSUED:

CANADA
Map 91A. Geological map of the Dominion of Canada and Newfoundland. Scale 100 miles to 1 inch
NEW BRUNSWICK AND NOVA SCOTIA.
Map 27A. Bathurst and vicinity, Gloucester County, New Brunswick. Geology.
Map 39A. Geological Map of Nova Scotia.
Map 121A. Franey Mine and Vicinity, Victoria County, N. S.
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Map 95A. Broadback River, Mistassini Territory, Quebec. Geology.
Map 100A. Bell River, Quebec. Geology.
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Map 124A. Wanapitei (Falconbridge, Street, Awrey, and Parts of Maclennan and Scadding Townships), Sudbury District, Ont. Geology.
Map 49A. Orillia sheet, Simcoe and Ontario Counties, Ontario. Topography.
NORTH-WEST PROVINCES
Map 55A. Geological map of Alberta, Saskatchewan and Manitoba
Map 117A. Wood Mountain Coal Area, Saskatchewan
BRITISH COLUMBIA
Map 33A. Nanaimo sheet, Vancouver Island, British Columbia. Topography
Map 70A. Victoria sheet, Vancouver Island. Geology.
Map 72A. Saanich sheet, Vancouver Island. Geology.
Map 109A. Prescott, Paxton and Lake Mines, Texada Island. Topography.
YUKON AND NORTH-WEST TERRITORIES
Map 113A. Canadian routes to White River District, Yukon, and to Chisana District, Alaska.

NOTE.—Maps published within the last two years may be had, printed on linen, for field use. A charge of ten cents is made for maps on linen.

The Geological Survey will, under certain limitations, give information and advice upon subjects relating to general and economic geology. Mineral and rock specimens, when accompanied by definite statements of localities, will be examined and their nature reported upon. Letters and samples that are of a Departmental nature, addressed to the Director, may be Mailed O.H.M.S. free of postage.

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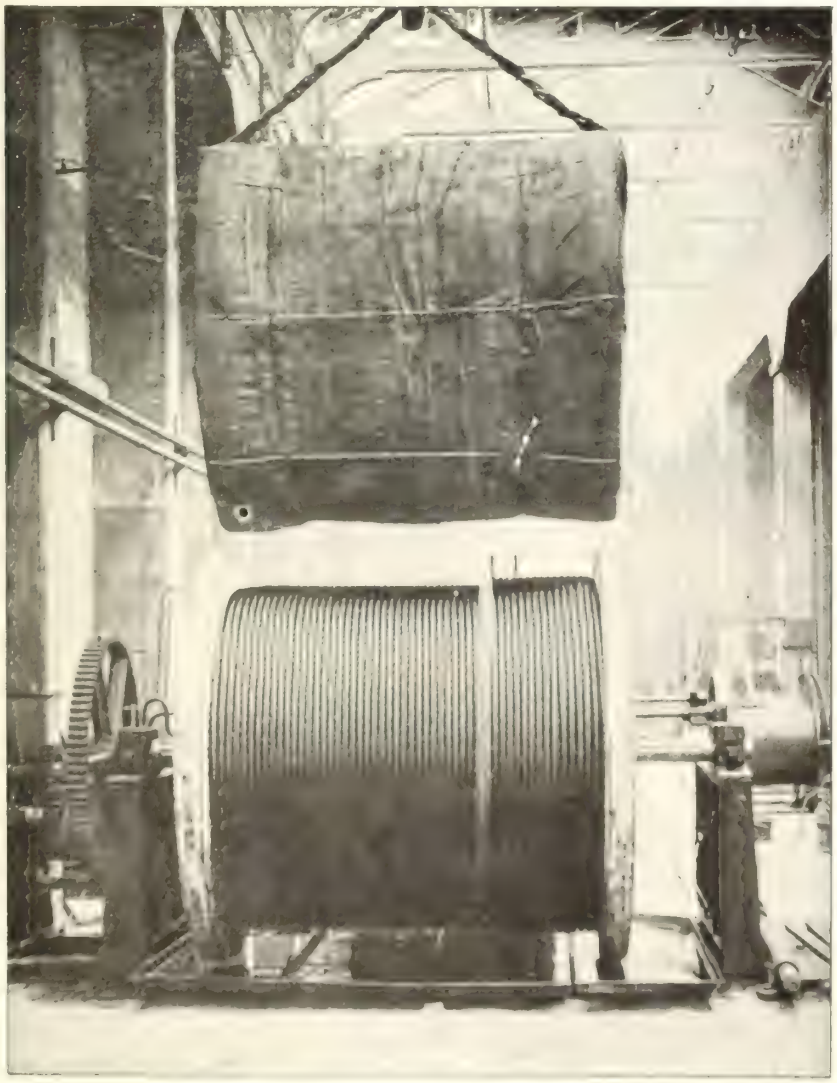

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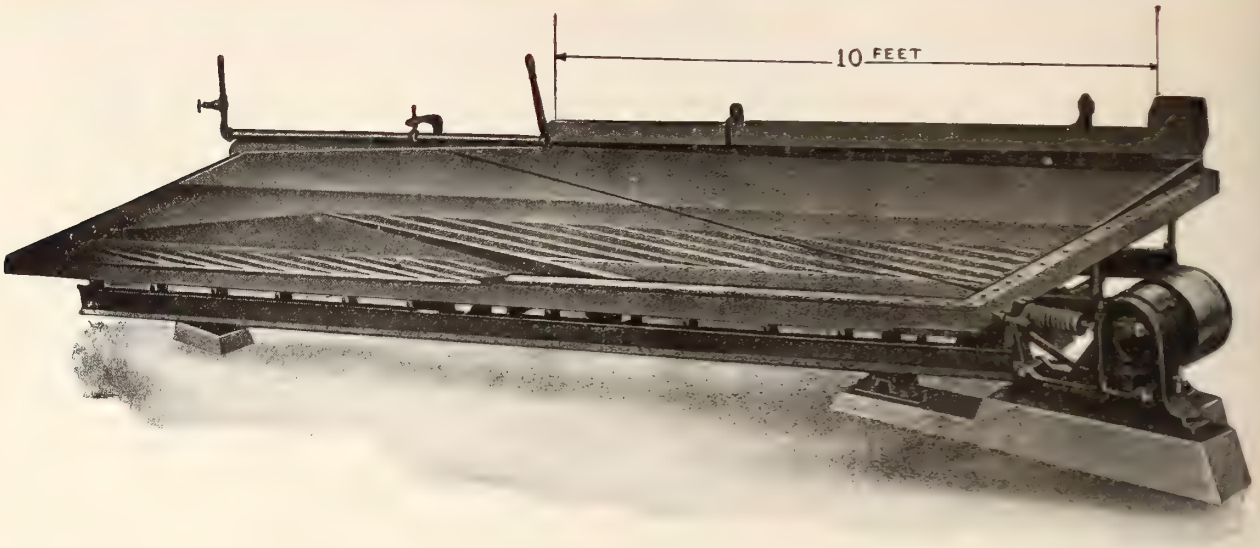

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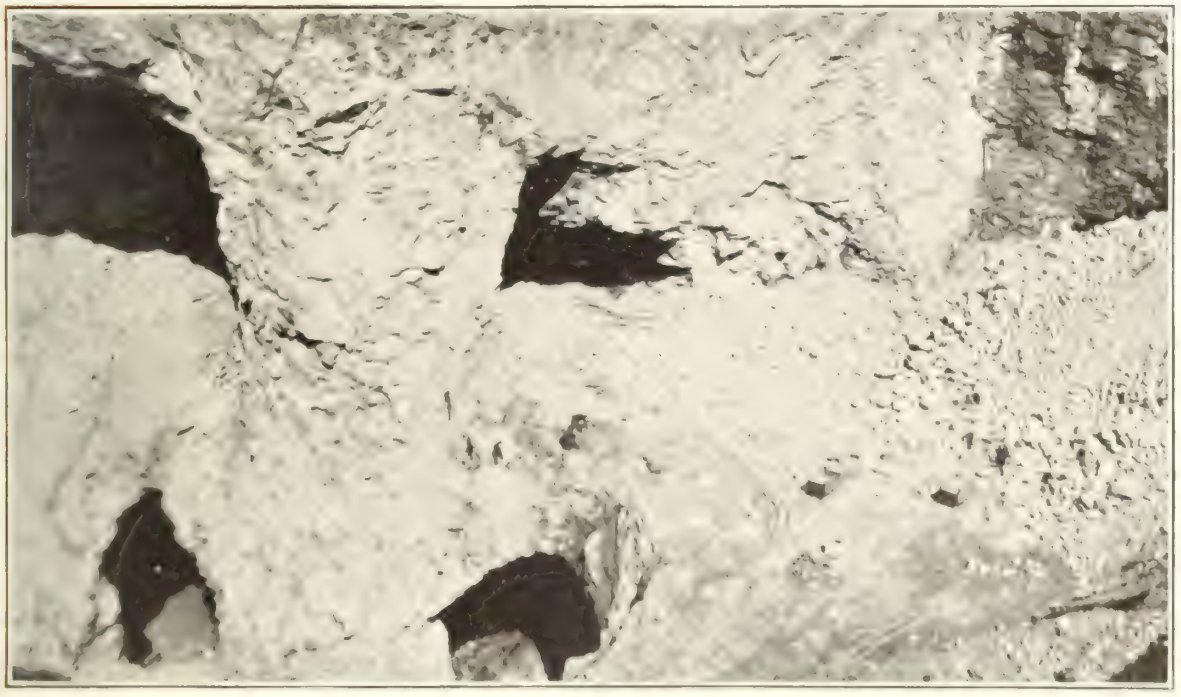

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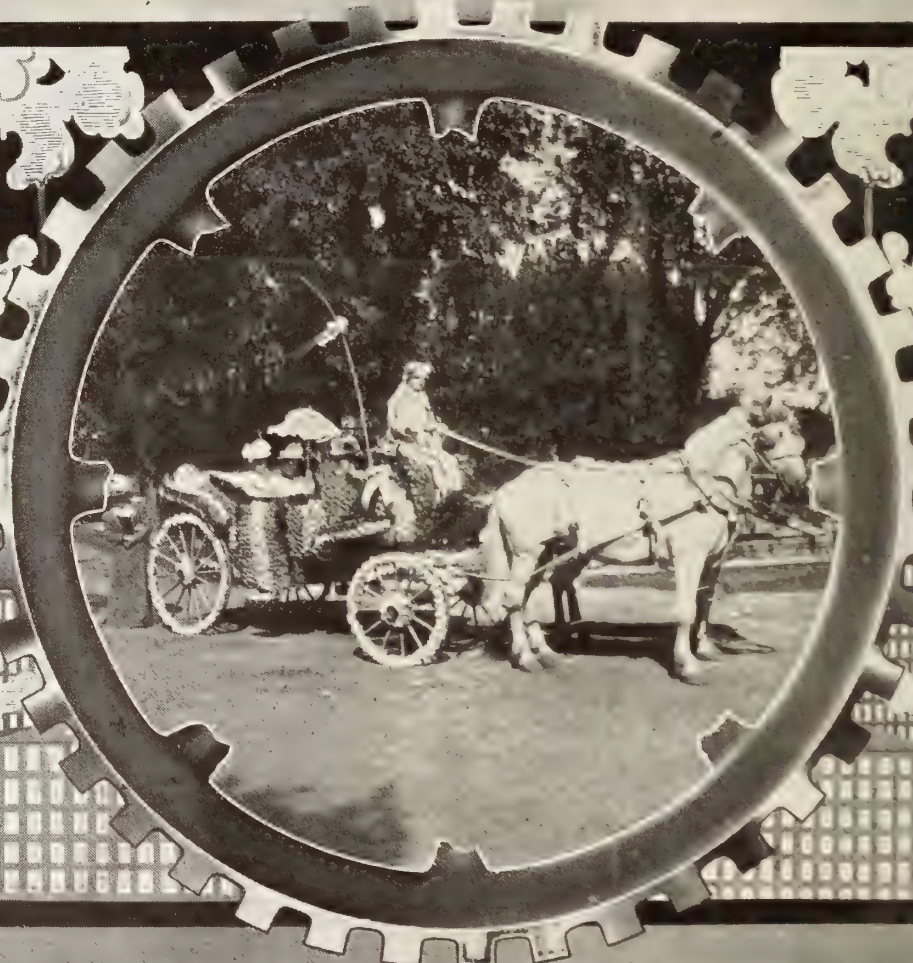

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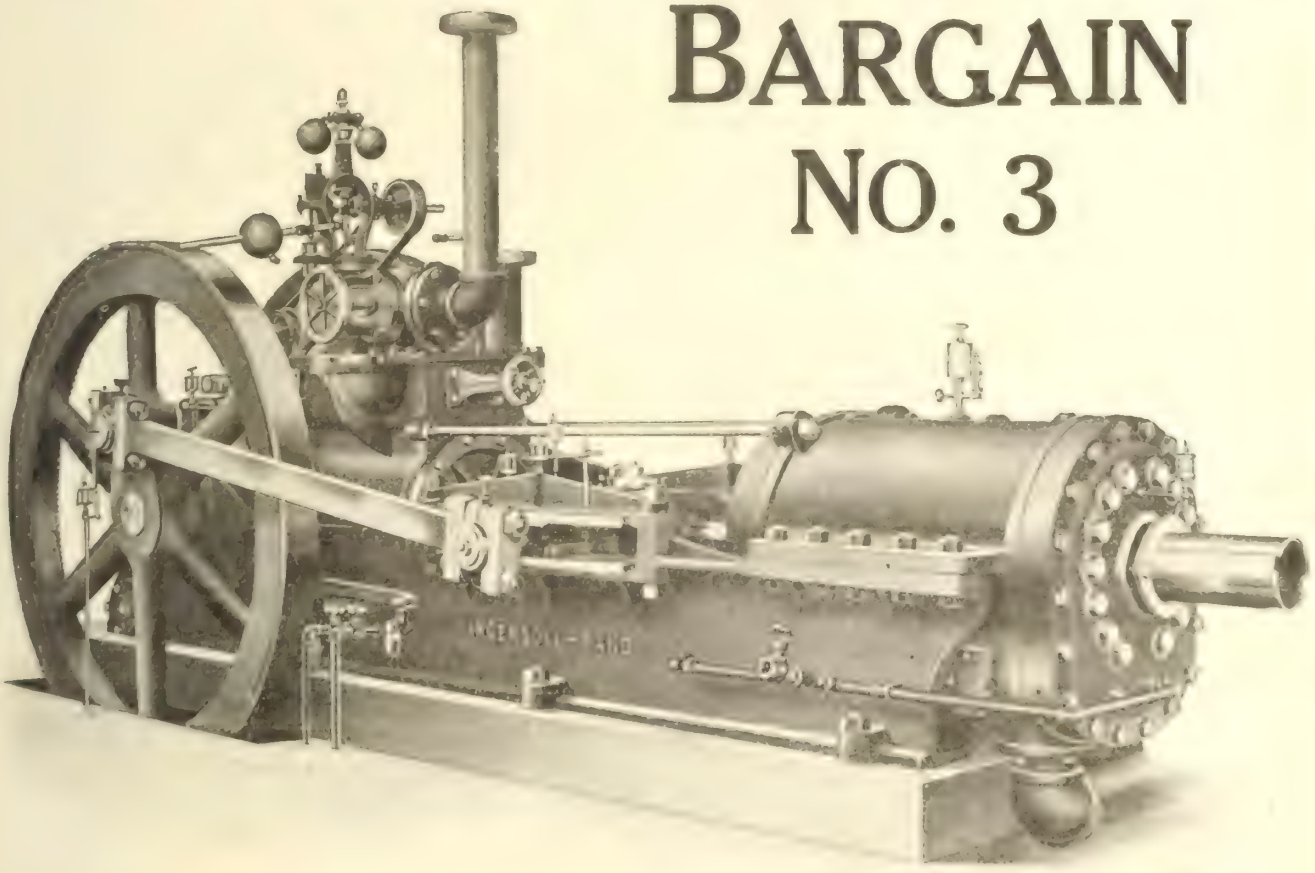

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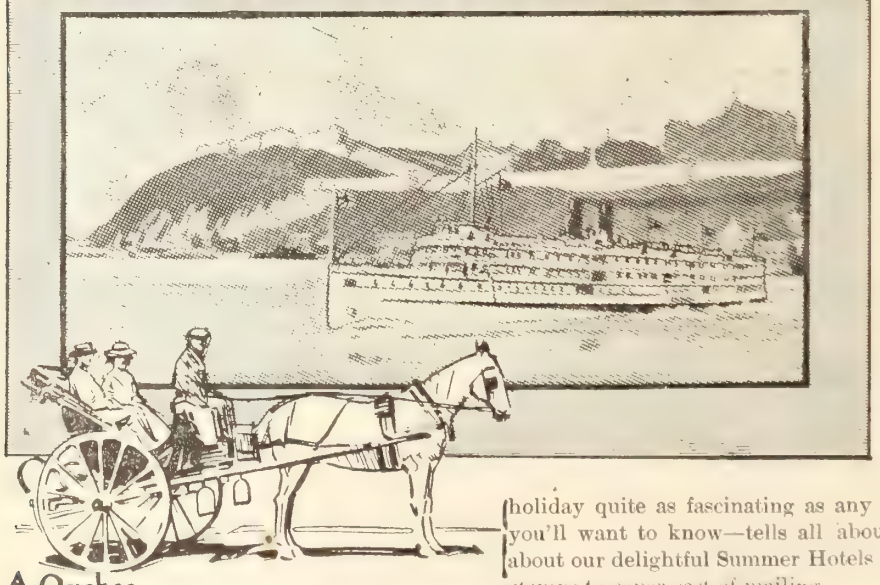

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Application for a lease must be made by the applicant in person to the Agent or Sub-Agent of the district in which the rights applied for are situated.

In surveyed territory the land must be described by sections, or legal sub-divisions of sections, and in unsurveyed territory the tract applied for shall be staked out by the applicant himself.

Each application must be accompanied by a fee of $5 which will be refunded if the rights applied for are not available, but not otherwise. A royalty shall be paid on the merchantable output of the mine at the rate of five cents per ton.

The person operating the mine shall furnish the Agent with sworn returns accounting for the full quantity of merchantable coal mined and pay the royalty thereon. If the coal mining rights are not being operated, such returns should be furnished at least once a year.

The lease will include the coal mining rights only, but the lessee may be permitted to purchase whatever available surface rights may be considered necessary for the working of the mine at the rate of $10.00 an acre.

For full information application should be made to the Secretary of the Department of the Interior, Ottawa, or to any Agent or Sub-Agent of Dominion Lands.

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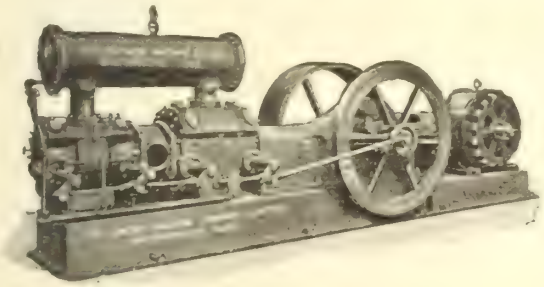

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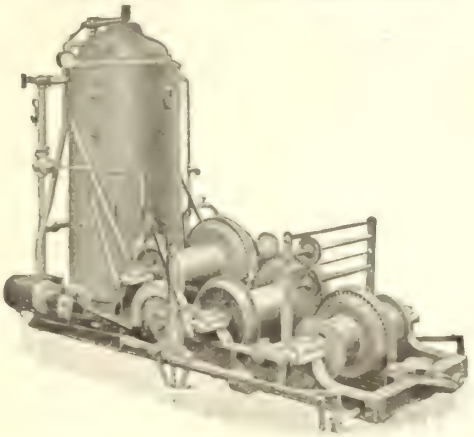

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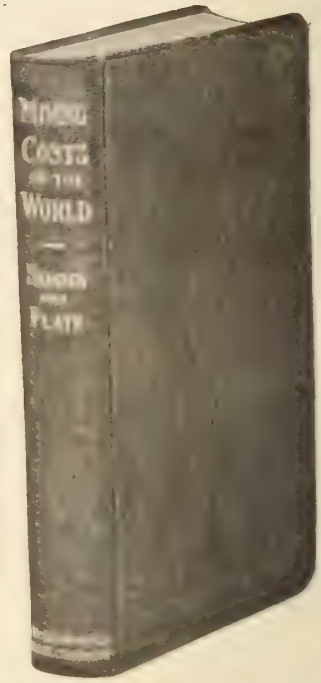

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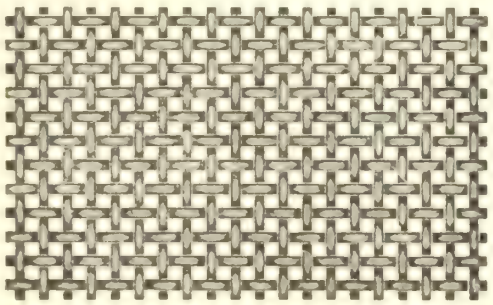

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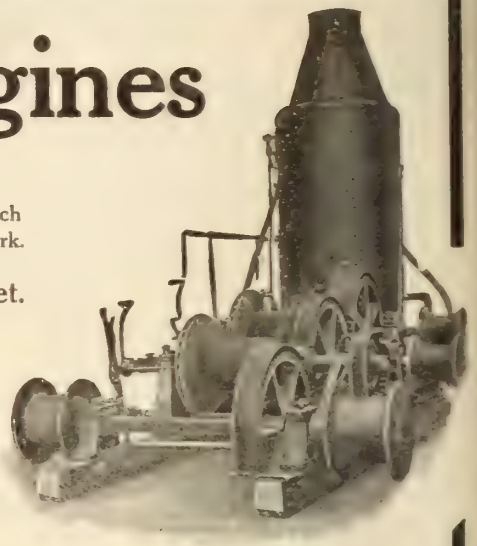

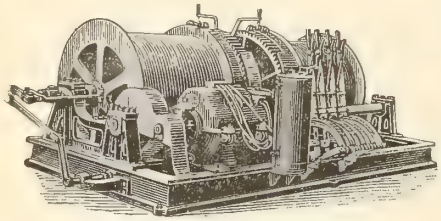

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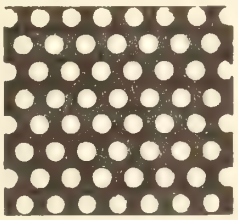

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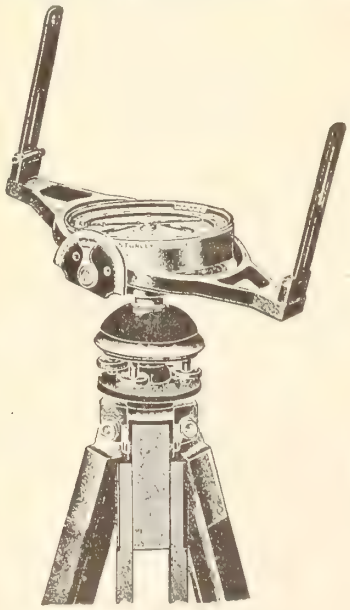

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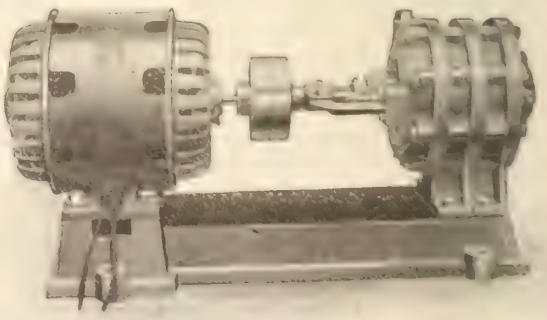

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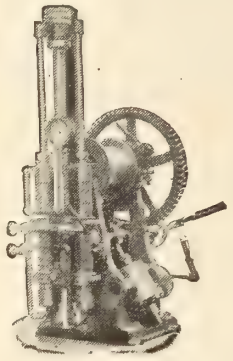

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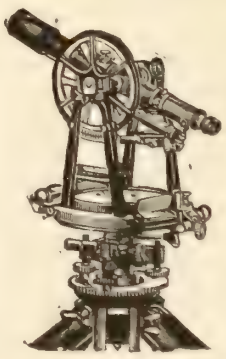

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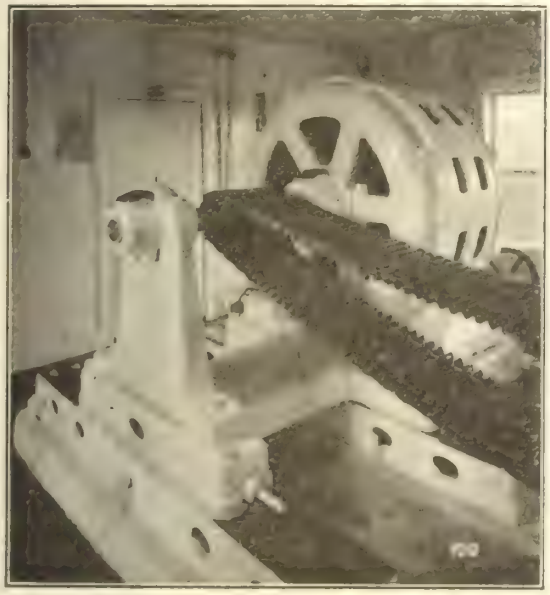

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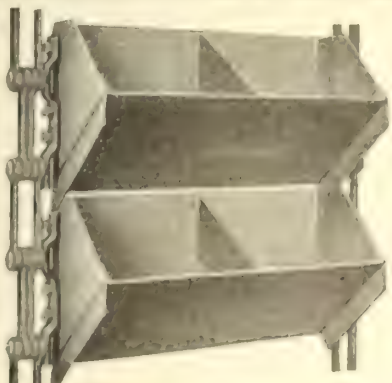

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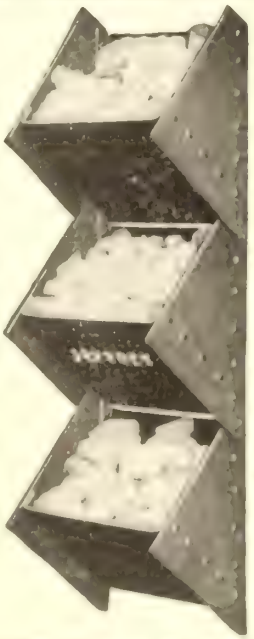

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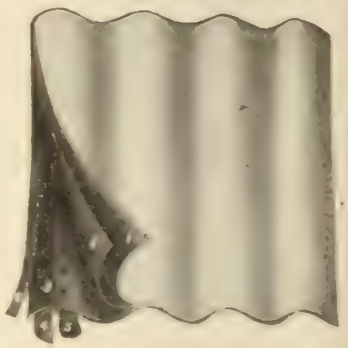

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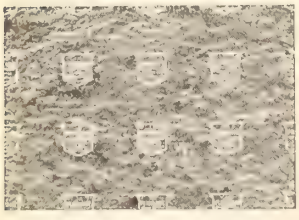

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THE CANADIAN MINING JOURNAL

VOL. XXXVI. TORONTO, Aug. 1, 1915. No. 15

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REGINALD E. HORE

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CIRCULATION

"Entered as second-class matter April 23rd, 1908, at the post office at Buffalo, N.Y., under the Act of Congress of March 3rd, 1879."

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MINERS AND THE WAR

The long threatened trouble in the coal mining districts of South Wales culminated in a strike which lasted only a few days. For weeks the mine owners and employees carried on a warfare which threatened to seriously interfere with the work of the British navy and of the armies in France.

It is said that the miners were dissatisfied because they believed the owners to be making large profits owing to the war. Naturally enough they desire to share in the profits.

It is not surprising that the miners asked for increased pay; but it is almost incredible that they should actually quit work in such a national crisis. Other miners have been playing a noble part in the war. Over two hundred thousand are enlisted and those at the front have proven that the miner is above the average as a soldier. With so many on active service it is necessary that those who remain at the collieries should work steadily. Even at best the output is lower than it should be and some authorities have advocated that miners should be brought back from the front in order that the output be increased. It must therefore have been very disheartening to all who have the interests of the British Empire at heart to learn that the coal miners of Wales had taken advantage of the embarrassing condition of affairs and gone on strike.

As a result of the strike not only was Britain threatened with a shortage of coal but France, robbed of her coal mines by the invading Huns, was placed in the same position. A prolonged strike in the Welsh coal districts at this time could do more damage to the Allies than could a score of German army corps.

Fortunately the disaster has been averted and, inspired by the words of Lloyd George, the miners have not only gone back to work, but they have done so with a better idea of the responsibility which rests upon them. A week has been lost but the miners have begun to realize that the issues which confront the Empire and we confidently expect soon to learn that they are working as diligently at their places in the mines as are the soldiers in the trenches in Flanders.

The announcement that the McIntyre Mining Company has purchased a controlling interest in the property of the Porcupine Mining Company at Timmins will be well received by those who wish to see the property developed. Whether shareholders become rich joy or sorrow depends on the price paid.

Col. Lessard, of the 65th Battalion, is distinguishing himself at the front. He is now reported to be making experiments in Holland with an apparatus which is said to combat the effects of poisonous gas.

THE NICKEL COMMISSION

The Minister of Lands, Forests and Mines of Ontario has announced the appointment of a commission to undertake an investigation of the nickel industry The intention to appoint such a commission was made public some months ago; but there was considerable delay in selecting the chairman, and consequently in announcing the names of the other members.

Obviously the best mining men in Ontario to undertake such an investigation for the Ontario Government are the officials of the Bureau of Mines. The Bureau already has information which it would take an outsider many months to collect, and in Mr. T. W. Gibson and Dr. W. G. Miller the Bureau has two most competent authorities. The Commission will be well posted as to local conditions.

Mr. George T. Holloway, who has been selected chairman of the Commission, is not well known here, but comes highly recommended by British authorities. He has been in practice as a consulting metallurgist and assayer since 1886 and has a fund of technical knowledge which should stand him in good stead in the investigation of the nickel industry.

The naming of Mr. McGregor Young as a member of the Commission indicates that political and legal aspects of the inquiry are expected to assume considerable importance. Mr. Young is professor of constitutional law and international law at the University of Toronto.

It is understood that the B. C. Copper Company will immediately start No. 1 furnace at Greenwood. The smelting plant is operated successfully on very low grade ore and might have been making a good profit during the past few months. It was closed down last fall when the low price of copper made operations unprofitable.

The production of nickel and copper in the Sudbury districts is now far above normal. At the mines and smelters many improvements have been made and efficiency has increased with the production.

Recently elected boards of directors of mining companies controlled by Calumet & Hecla Mining Company show many new names. The boards of subsidiary companies were formerly largely made up of directors of the controlling company. The interlocking directorates are now disappearing.

Mr. H. C. Hoover, who is directing the work of the American Commission for Relief in Belgium, is achieving great things in the German-ridden country. Mining engineers are proud to belong to the same profession as Mr. Hoover.

In a paper to be presented at the San Francisco meeting of the American Institute of Mining Engineers, Mr. Nathaniel Herz, of Lead, S.D., gives a record of observations made while testing a large variety of zinc-dust samples. He concludes that for precipitation of precious metals the zinc-dust should be fine; "most of it should pass through a 200-mesh screen and the fine portion should be very much finer than the screen opening."

The Geological Survey has issued a report by Mr. C. L. Cumming on "The Artesian Wells of Montreal." An interesting feature of the report is the conclusion that the waters can be classified areally, but not according to depth. The author of the report is able to map out areas distinguished by a high content of calcium chloride, calcium sulphate and sodium, respectively.

Copper and spelter are now selling at about the same price—19 to 19½ cents a pound. The demand recently has not been as good as it was a month ago; but many authorities believe that good prices will continue. The chief present concern of owners of copper and zinc mines is how to increase the capacity of their plants, to take advantage of the good market.

The report of Mr. Theo. C. Denis, Superintendent of Mines, of Quebec, on mining operations in Quebec during 1914, has been published. The statistics compiled by the Quebec Mines Branch show that the mineral production of the Province during the year ending December 31st, 1914, reached a total value of $11,732,783. As compared with the previous year, when a value of $13,119,811 was recorded, this is a decrease of $1,387,028, or of 10.57 per cent. Owing to the very abnormal conditions which marked the whole second half of the year 1914, it is a matter of gratification that the figures have not shown a greater falling off. As it is, the total mineral production is greater than that recorded for 1912, when it was $11,187,110. The revised figures of the mineral production of the Province of Quebec during the year 1914, were preceded by a preliminary statistical statement, which was issued on February 23rd, 1915, and appeared in the "Journal" March 1. These preliminary statistics, which were published subject to revision, gave a close approximation, at an early date, of the production of the various mineral substances during the year. In fact, the total given in this early statement only differed by $407,355, or 3.47 per cent., from the finally revised figures.

DOME MINES.

The following statement, which lacks official confirmation, has appeared in several Eastern papers.

Recent development work of Dome Mines Co. has added 375,000 tons of high grade ore to the company's ore reserves. Estimated value of this ore is $5,625,000 on conservative basis of $15 a ton, although much of it runs $19 and $21.43 a ton. At the close of the last fiscal year on March 31, the company's ore reserves were valued at $11,576,857, so that additional ore blocked out in barely more than three months since brings value of ore reserves to $17,201,857. Further development work is expected to add greatly to reserves of high grade ore.

THE PROSPECTOR'S DIFFICULTIES

To the Editor of the Canadian Mining Journal:

Sir,—In your last issue you, like the Mail and Empire of July 10th, advise prospectors to get into the bush. That may appear an easy matter; but in the same issue you give one of the main reasons for staying out, namely, the state of the roads. If it takes seven hours to get from Gowganda to Elk Lake, how long will it take to go from Ruell to Gowganda?

It has been stated that the Government was going to do something to assist the prospector; but it does not look like that to some of us. Moreover, it's not only prospectors who should go into the bush, but Government representatives who can state facts in reasonable time, instead of taking 18 months or two years to give out information.

About two years since the Government did start to cut a road to West Shiningtree lake, just under 20 miles. About twelve miles was graded. Last May twelvemonth I tried that road by wagon from mile 85. The first twelve miles was fairly good. Then came the bumps. I drove on until I could stand it no longer. Then I started to walk, while three cases of eggs ran out of the wagon. At seventeen miles the wagon could be drawn no further. So after paying for the trip I had to carry the load myself the last three miles. This three miles was a terror, and on arrival at the Lake I was wet up to the armpit, having gone into holes that deep through snow slush.

I learn that the road is not improved to-day. Why? Surely not because the Government does not get the money, for almost four townships have been staked and recorded there, and every prospector pays $5 license fee, with $10 for permit, and then does assessment work on each claim. Together with recording fee $10, traveling expenses, etc., would bring cost of each claim to easily $650. How can prospectors stand that long? Well, there are not many left now. I could say a lot more, but I think it would go into the waste-basket.

It is not more or better prospecting that is required; but capital to develop what has been discovered. Then the prospector would take heart.

Yours, etc.,

Chapleau, Ont., July 21 ROBERT HOLDING

The Editor of the Canadian Mining Journal:

Sir,—In closing my letter yesterday I neglected one or two items which I had intended to mention.

Regarding cost to prospectors. I don't see the justice of the $10 fee—renewable annually—in special mining divisions as at present called for in Ontario.

Regarding the estimate of $650. To this must be added survey. This is no small item; but varies according to distances and chances of others taking advantage of the presence of the surveyor. [illegible] this must be added $1 per acre the first year after issue of lease.

I hold that there are few prospectors who can honestly conduct operations in accordance with the Mines Act without some outside assistance, which is secured usually from a man who has little or no knowledge of the subject and who soon tires of finding money. The result is delay, and probably loss. Now we come to consideration of an attempted sale. Things are different to-day to what they were during Porcupine days, and even now it would appear Porcupine should allure capital. Even at Porcupine many good prospects do not get recognition. It is therefore disheartening to men who have speculated their savings, roughed it winter and summer when they are required to prove by every means what they have by stripping, sinking, etc., before their claims will be even looked at.

Regarding roads, why not utilize the alien labor now so plentiful and costly to the people, instead of allowing these alien enemies to go to the mad house owing to want of occupation?

Yours, etc.,

Chapleau, Ont., July 22, ROBT. HOLDING.

On January 1 the Journal published a communication relative to the mineral production of British Columbia in 1914, received from its regular correspondent in that Province, who, about the middle of December, wrote as follows:

"As the year draws to its close it is possible to make a rough estimate of the value of the mineral production of British Columbia during 1914. With only very incomplete information as a guide, it seems probable that a total value of between $25,000,000 and $26,000,000 may be estimated. It may be the latter amount will be slightly exceeded, but at this writing it seems better to place the total at somewhere about $25,900,000. Of this amount, approximate proportions are: Metalliferous minerals $15,100,000, coal and coke $7,800,000, and miscellaneous products $3,000,000." As the official revised figures are now published, a comparison may be made; they show the following sub-totals: Metalliferour minerals $15,790,061, coal and coke $7,745,847 and miscellaneous products $2,852,917; total $26,388,825. The net difference between the total as estimated early in December by our correspondent and that arrived at by the Provincial Department of Mines after all official and other returns had been received was $488,825, the estimate published by the Journal six months ago having been that amount less that the official total made public last month.

Among the publications issued recently by the United States Geological Survey is Professional Paper No. 87, Geology and Ore Deposits of Copper Mountain and Kasaan Peninsula, Alaska, by C. W. Wright, 1915. This is described in an official list of new publications as follows: A detailed description of the geology of Kasaan peninsula and Copper mountain, the two most important copper-bearing areas in southeastern Alaska, [illegible] of the geology of the Ketchikan district, within which these areas lie. The mining development is only briefly discussed, because it is not of permanent interest and is fully treated in the Survey's annual bulletins showing the progress of investigations of mineral resources in Alaska. The genesis and occurrence of the copper ores are discussed, and special attention is paid to contact deposits, which are well exemplified in this region. The illustrations include a geologic map of the Ketchikan district, topographic and geologic maps of Copper mountain and Kasaan peninsula, plans and sections of mines, and half-tone views of rocks and minerals from the areas discussed. The Granby Consolidated Co. is operating several mines on Kasaan peninsula.

During the first quarter of the current fiscal year, ended June 30, there were received at the Dominion Assay Office, Vancouver, B.C., 387 deposits of gold bullion, as summarized with 271 for the corresponding quarter of 1914. The number received in June, 1915, namely, 165, was much larger than that in June, 1914.

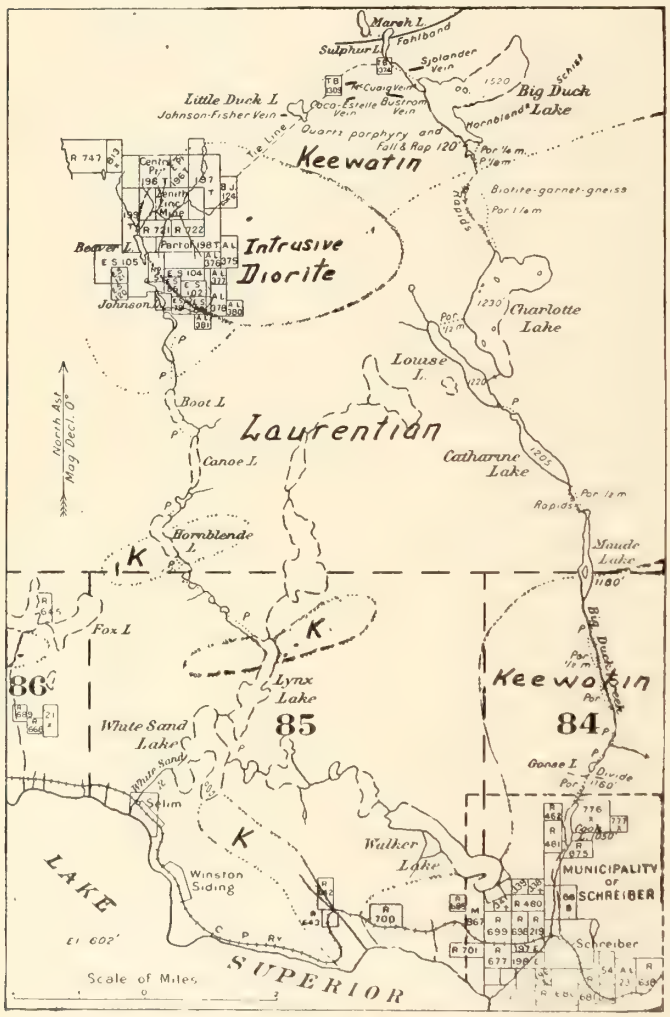
SCHREIBER OR BIG DUCK LAKE GOLD AREA.

According to memorandum issued by Dr. W. G. Miller, of the Bureau of Mines, to accompany a map of the Schreiber area by P. E. Hopkins, not much has been done as yet to develop this area. The following information may be of some use to anyone desiring it. Mr. McCuaig, of Schreiber, and the gentlemen whose addresses are given as Nipigon, will be able to furnish further information. Canoes and guides can be obtained, it is said, at Schreiber.

J. Bustrom, Nipigon, is owner of T.B. 2071; Dave McCuaig, Schreiber, is owner of T.B. 1686; Carl

GEOLOGY AND CANOE ROUTES
FROM
Schreiber to Big Duck Lake

To accompany Report by P. E. Hopkins, in Part I, Vol. 24, Report of Ontario Bureau of Mines, 1915
Hon. G. H. Ferguson, *Minister.* Willet G. Miller, *Provincial Geologist.*



Sjolander, Nipigon, and Mr. McKirdy, merchant, Nipigon, are owners of T.B. 1861 and 1955. These owners may not have full control of the claims, but this is the information at hand.

The J. Johnson claim, south of Little Duck lake, gave from a sample across 5 ft., $7.60. It apparently did not show any visible gold. The Coco-Estelle claim, T.B. 2093, gave from a sample across 4 ft. of quartz and pyrites, $8.60. The McCuaig claim, T.B. 1686, is said to contain rich gold ore, so rich that some of it has been hand-picked and shipped during the last winter. The Sjolander-McKirdy claims are said to have a large vein which has a pay streak near the hanging wall. The Bustrom claim is said to have a large vein, the samples from which gave 2 per cent. copper and 20 cents gold.

BEAVER.

Under date of July 14, 1915, President F. L. Culver sent out the following letter:

To the Shareholders of Beaver Consolidated Mines, Limited:

The first quarter of the company's year (1915-16) terminated on the 31st of May. About May 1st, the contract for power which existed between Beaven Consolidated Mines, Ltd., and the Northern Ontario Light and Power Company expired. Since that time matters have been in a very unsettled condition between the two companies and we did not wish to send out our report until we were in a position to give the shareholders some information in regard to this subject. The new contract submitted by the Power Company contained terms and conditions which your directors did not deem advisable to accept, and it looked for a time as though it would be necessary to join with the Temiskaming Mining Company, our neighbors who were experiencing similar difficulties, in the erection of a plant of sufficient capacity to supply both companies with power. This would involve the expenditure of a large amount of money. However, after several conferences with the Power Company, arrangements have been made so that we will continue operations temporarily under practically the old conditions.

The development work for the quarter is as follows: Drifting, 1,039 ft.; crosscutting, 204 ft.; raising, 75 ft.; total, 1,318 ft.; stoping, 1,440 cu. yds.

The main shaft is down to a depth of 1,000 ft., and it is our intention to continue sinking until we go through the diabase sill and reach the lower contact. As we have previously advised you, our operations are at a minimum owing to the low price of silver, consequently development work has not been as large as in previous quarters. We are disposing of just sufficient silver from time to time to pay our operating expenses, carrying a large amount of silver bullion in storage in New York.

We have found it necessary to increase the capacity of the concentrating mill to 150 tons a day. This new installation will be completed in about six weeks.

May 31st.	Ozs.
Bullion in storage in New York..	259,480.10
Ore in transit and at smelters ...	65,899.97
Ore bagged at mine	41,221.40
Total.	366,601 47
Cash on hand	$79,846.95

Mr. Frederick G. Cottrell, of San Francisco, California, chief physical chemist for the U. S. Bureau of Mines; Mr. D. A. Lyon, of Salt Lake City, also an official of the Bureau, but who is in charge of the Department of Metallurgical Research at the Utah University, and Mr. W. H. Howard, of Salt Lake City, general superintendent of the American Smelting and Refining Co.'s Utah division, and practically at the head of its research department in that part of the United States, visited the Consolidated Mining and Smelting Co.'s smelting works at Trail, B.C., on July 18, going thence via Nelson to the Coeur d'Alene district of Idaho. Their purpose in going to Trail is stated to have been to ascertain what progress had been made there in connection with experiments in the reduction of lead-zinc ores.

VANADIUM: ITS CHEMICAL AND METALLURGICAL TECHNOLOGY

By F. M. Turner, Jr.

On account of its ever increasing use in the making of special steels for automobiles and railroad purposes vanadium alloys are now produced in such large quantities and the ores of the metal mined and sought for to such a degree that it can no longer be spoken of as a "rare element" as was the case even ten years ago. Hardly more than ten years ago vanadium compounds were known only to the dealer in chemicals who handled a few costly salts of the metal, for which there was a limited industrial application. When ferro-vanadium first began to be manufactured, after it was found that its addition improved the quality of steel, the limited sources of vanadium ores were soon exhausted, and the price asked for the alloy was so high as to make steels containing it of little more than academic interest. Moreover, the impurities contained in the early ferro-vanadiums were so great that the results obtained on its addition were often far different from what was expected and it took some little time for the use of the element to rise into favor. To-day all has changed. A large American company has, after the expenditure of vast amounts of capital, rendered accessible enormous supplies of vanadium ore of high-grade quality in South America. By the maintenance of large and well-equipped research laboratories they have improved the methods of production so as to guarantee a uniform product to the user and have so standardized and improved their process as to make the price but a small fraction of what it was necessary to charge some years ago. Academic and industrial investigators in America, England, France and Germany have studied the properties of the alloys of the metal with iron, carbon, manganese and other metals and to-day the user of ferro-vanadium does not have to rely altogether on empirical rules, but can know largely in advance the exact effect of the addition of the element to steel, and the most efficient manner to accomplish the desired result.

Historical sketch.—To a Mexican, Del Rio, belongs almost, but not quite, the honor of the discovery of this most useful element. Del Rio actually discovered it, but he was led by circumstances to renounce his own discovery.

For the following facts about Del Rio, the writer is indebted to an article in the Bulletin of the Pan American Union written by Mr. Wells of their staff, who by careful research in the archives of Mexico and Spain found the details of Del Rio's career and his great discovery. Andres Manuel Del Rio Professor of Mineralogy in the Royal School of Mines of the City of Mexico, was born in Madrid in 1764 and graduated from the University of Alcala de Henares in 1780. He was pensioned by the Spanish government and sent to study in England, France and Germany. There he spent about twelve years, studying mineralogy and mining, and worked with many great scientists among others, Lavoisier. When he returned to Spain he was made one of a group of savants who were sent to Mexico to establish the Royal School of Mines in Mexico and give the position of Professor of Chemistry. He later asked that the title be changed to Professor of Mineralogy. The school opened in 1795. Del Roi became interested in politics and was one of the advocates of Mexican independence. After the expulsion of the Spaniards from

AMERICAN VANADIUM COMPANY'S NEW PLANT

Mexico he lived for a time in the United States, but returned to Mexico and died there in 1849.

A district in the State of Chihuahua, where so many great mines are located, is named after this pioneer of learning in Mexico. In 1801 when examining some lead ores from the mines at Zimapan in the State of Hidalgo, Del Rio thought he detected a new element, and he called it erythronium, from a Greek word for red, since its salts with certain chemicals gave a bright red color. He thought it was allied to chromium, and had he left well enough alone erythronium would be its name today and Del Rio alone would be hailed as its discoverer. Unfortunately Del Rio bowed to authority and when Collet Descotils, the great French analyst, published an article calling Del Rio's erythronium merely impure chromium, Del Rio accepted his decision and in the Annales de Ciencias Naturales, Madrid, 1804, disavowed his former claim and stated the substance to be a lead chromate. So the matter rested till 1830, and we might very appropriately call the vanadium "the element that got lost" for during this long period nothing was heard of it at all.

In 1830 Sefstroem, a Swedish metallurgist, found a new constituent in the slags of the famous Swedish iron of Tabberg. Not knowing of Del Rio's discovery he thought he had a new element, and he named it after a Norse divinity, calling it vanadium, from Vanadis, the surname of the goddess "Freya." In the same year Woehler proved the identity of vanadium and erythronium, and the next year the great chemist Berzelius made an exhaustive study of the element and its compounds. Although full of mis-statements which have since been corrected, and which were inseparable from the work on account of the newness of the subject, this treatise of Berzelius's remained the source of most of the information about this element till 1867 when Sir H. E. Roscoe made a thorough and accurate study of the chemistry of vanadium, Roscoe's pioneer work has been the starting point of most of the subsequent researches on the subject.

The chief error made by Berzelius was the mistaking of the lowest oxide of the element for the element itself, which threw out all his other formulae. This also led to his classing the element with chromium and molybdenum, in which opinion Woehler concurred. On account of the prestige of these two great names it was so regarded without a doubt till Schabus and Rammelsberg showed the perfect analogy between vanadinite, apatite and pyromorphite, and, mineralogical ideas carrying great weight just at that time in chemistry, this disturbing factor opened the minds of the chemical world to a change, and as a result of Roscoe's work it was placed where it is now known to properly belong, in the fifth group of Mendeleeff's Table, along with niobium and tantalum, forming a sub-group closely related to nitrogen, phosphorus, arsenic, etc. At present the analogies between vanadium and phosphorus and arsenic are more striking than those between vanadium and the other elements of its own group, but when the compounds of niobium and tantalum are further investigated this will be cleared up. The salts of the per-acids of vanadium, niobium and tantalum, which have recently been investigated by Melikoff and Pissarjewsky in Russia, are, however, quite analogous, and no doubt many other similarities will be found.

Early uses.—Early in the sixties vanadium began to play a certain role in industry and it was discovered that it was a remarkably efficient agent for the formation of aniline-black from aniline. At this time all the world's vanadium was obtained from the slags of the Creusot steel works in France. Later as slightly more was used it was extracted from lead vanadates mined in Spain by a process due to Herrenschmidt. In this process the ore was roasted with soda and charcoal, giving lead which carried a good deal of silver and a slag from which vanadium was worked up in the form of a solution of sodium vanadate. From this ammonium vanadate was precipitated and this was roasted and the oxide prepared and sold. Later iron and nickel vanadates were precipitated from the solution and these reduced aluminothermically, but in no case was the price of vanadium much reduced. The process was not at all efficient, 2 per cent. of the vanadium being left in the slag and arsenic, which was objectionable, being carried into the finished product. Inventions were made to get around both these difficulties, but soon after this more easily worked ores and better processes were invented and no commercial vanadium is now prepared in this way.

About 1910 the usefulness of vanadium in steel was demonstrated beyond a doubt by French investigators. Choubley in 1896 seems to have been the first to make this important discovery. Choubley was director of the steel works at Firminy. Neither his researches nor those of Helouis the next year were very successful and the first real advance in this direction was made by Arnold in England in 1900. Immediately a large demand was created for vanadium and mines being opened up in various parts of the world its price fell from the very high one it had formerly remained at, to that of a commercial product. Curiously enough, German chemists, usually so much to the front, played little or no part in the development of vanadium, France, America and England leading in the order named. Moissan was the first to prepare pure vanadium in the electric furnace and Gin made a fairly good grade of ferro-vanadium by the aluminothermic method. The process for the treatment of the ore and the production of vanadium products on a large scale has been worked out in America, but to the French and English we owe most of our exact knowledge of the structure and metallography of the steels to which vanadium is added, Guillet in France and Arnold in England being the chief workers on the subject.

Occurrence of Vanadium. Vanadium is a singularly widely distributed element, but in most places where it is found it is in quantities so small as to be of no practical importance. It occurs in the sun, in almost all rocks both igneous and stratified, in sea-water, in coal in petroleum and in plants. Many commercial products such as alkalies, acids and pig-iron contain some vanadium.

A large number of vanadium minerals of well-defined composition and form are known, but only a few are of either academic or commercial importance. Vanadinite is described in all text-books as the chief vanadium mineral, and until a few years ago it was so. It is isomorphous with pyromorphite and apatite and has the composition $(PbO)_3.V_2O_5.PbCl_2$. It is found in many parts of the world. It is generally of an orange or red color and occurs in hexagonal prisms. When the lead is partly replaced by zinc the mineral is known as dechenite arcoxene or eusynchite according to the extent of the substitution. When there is no chlorine present it is known as descloizite, which crystalizes in the orthorhombic system, and can be considered a lead pyrovanadate. Cuprodescloizite, brackebuschite, eusmirite, tritochorite and psittacinite are all varieties of this mineral containing various admixtures of copper and zinc. The volborthites and calcovolborthites are copper vanadates discovered in Europe. Pucherite is a vanadate of

bismuth found in Saxony. Calcium vanadate, called vanadiolith, has been found, and also free vanadic acid has been discovered on the shores of Lake Superior in small quantities. Good specimens of nearly all these minerals, and of many varieties of some of them may be seen in the National Museum at Washington, D.C., and some of them, especially the vanadinites, are very beautiful.

Roscoelite is a vanadium mica which has been mined for many years in the western part of the United States and contains about 25 per cent. V_2O_3. As one might suppose from its being a mica, it presents great difficulties in treatment, and vanadium products prepared from roscoelite find it hard to compete with those from more readily worked ores.

Carnotite is now a well-known mineral. It occurs on sandstone and other substances as a yellow incrustation or impregnation. It is a potassium-uranyl vanadate and possess the formula: $K_2O2UO_3V_2O_5 3\ H_2O$. It has been largely mined in Colorado and Utah as a source of radium, and most of the world's radium to-day is made by a Pittsburgh corporation from the uranium content of this ore. It has not yet been found practical to use it as an ore of vanadium, even with the radium as a valuable by-product, but research work is being done continually on this proposition by the corporation alluded to, which controls immense holdings of carnotite deposits. The United States Bureau of Mines is also making radium from carnotite and selling the vanadium residues to a steel concern which works them up into vanadium alloys.

Immense amounts of impregnated sandstones, with small, but uniform, content of vanadium go under the name of vanadiferous sandstone and await a metallurgical process sufficiently efficient to extract their small vanadium content.

The most important and the most curious ore of vanadium is patronite, an impure sulphide of vanadium containing much free sulphur, which occurs in asphaltite deposits in the Peruvian Andes. These deposits were discovered in 1905 by Patson, after whom the ore is named. These mines have been developed and are owned by the American Vanadium Company, of Pittsburgh, who ship the ore from Callao to their plant at Bridgeville near Pittsburgh, where it is made into ferro-vanadium. Over 75 per cent. of the world's production is made by this company, from this source. The patronite is not shipped as mined, but is roasted at a plant at the mines, probably the most fully industrial establishment in the world, as it is very near the summit of the Andes. The increase in vanadium-content made by this simple operation is readily seen by an inspection of the two following analyses made by Kent-Smith.

Before Roasting—	Per. Cent.
VS_3	39.84
MoS_2	1.57
FeS	4.07
NiS	1.49
S	30.57
SiO_2	13.60
Al_2O_3	2.46
Alkalies, rare earths, lime	1.40
Moisture	5.00
After Roasting—	**Per Cent.**
V_2O_5	58.08
MoO_3	2.62
Fe_2O_3	4.98
NiO	2.24
S	0.23
SiO_2	25.00
Al_2O_3	4.52
Alkalies, rare earths, lime	2.56

By this operation the vanadium content is raised from less than 14 per cent. to rather more than 30 per cent. In the same deposits with the patronite appear other minerals which seem to be oxidation products of patronite, but are not mined. The genesis of these deposits is a complete mystery, but it seems to be in some way connected with the highly vanadiferous lignites of Mendoza and other places and the vanadiferous asphaltites of Yauli.

VANADIUM ORE TRAIN, PERU

Physical and chemical properties of vanadium. Pure metallic vanadium was prepared for the first time in 1904 on a very small scale, and consequently the many published statements regarding the physical properties of the element prior to this date are of small value. Roscoe tried to obtain it by reducing VCl_3 with hydrogen, and obtained a silvery metallic powder which, however, contained some hydrogen. Moissan's vanadium obtained in the electric furnace contained considerable carbon. It was ductile and exhibited a metallic fracture. Weiss and Aichel reduced oxides of vanadium with thermit and obtained a white regulus which showed facets of hexagonal rhombohedric crystals, which agreed well with the element's position in Mendeleeff's Table along with arsenic, antimony and bismuth, which also take this habit.

According to the most reliable data pure metallic vanadium is a hard white lustrous metal. It is the hardest of metals, its hardness being above 7 on the mineralogists's scale. It is not scratched by quartz or steel. It is not magnetic. The density of perfectly pure vanadium is not known, but Moissan's vanadium containing about 5 per cent. carbon possessed a specific gravity of 5.8, and the hydrogen-containing material of Roscoe a specific gravity of 5.5. According to Mache its specific heat between zero and one hundred degrees is 0.1153. Smith reported its melting point to be above 2000°C., and Moissan said that although it would melt in his electric furnace it took a higher heat than any other metal, but it is now known pretty definitely from the work of Werner von Volton and others that the melting point is not so high, about 1680° being near the right temperature. His data were obtained from photometric measurements of great accuracy. Its atomic weight is 51 in round numbers.

The most noteworthy general chemical property of the metal is the great number of compounds to which it gives rise and the extraordinary readiness with which it combines with most elements. When not heated it does not oxidize readily in the air, and preserves a bright lustre for weeks at a time, but very little heat will cause it to take on a coating of vanadium pentoxide, V_2O_5. According to Chilesotti, hydrochloric, hydrobromic and cold sulphuric acids and potassium hydroxide have no effect on the metal. Hot sulphuric acid and hot solutions of potassium hydroxide attack it readily, and it dissolves rapidly in nitric acid and aqua regia forming green solutions. It alloys readily with iron, nickel, cobalt, copper, aluminum, tin, platinum and other metals. It also forms binary compounds with silicon, phosphorus, nitrogen and carbon, and possibly with hydrogen. Colloidal vanadium has been obtained by Svedberg by his usual method, using some of the higher alcohols (e.g. isobutyl) as the solvent, and these solutions, which are dark brown in color, are stable for several weeks.

Vanadium forms five well defined oxides. These are the pentoxide, V_2O_5, often alluded to as vanadic acid, the tetroxide V_2O_4, the trioxide V_2O_3, and the lower oxides VO and V_2O. Each of these except the last forms series of salts with acids, and two of them form acids which give rise to vanadates and vanadites and a host of more complex compounds. When vanadium can find nothing else to combine with it combines with itself, and vanadates of the radical (VO) called vanadyl are well known. The nomenclature of these various oxides and their compounds is very unsettled, and the best that can be done is to refer the reader to Gmelin-Kraut, Bd. III. Ab. 2, page 73 et seq., where the whole matter is discussed at length. Other intermediate oxides have been reported, but they probably are mixtures of those listed above.

The interesting thing about these oxides is the ease with which one is converted into the other, especially in the case of the tetroxide and pentoxide. Vanadium pentoxide is reduced to tetroxide and again takes up oxygen from any oxidizing agents present with such rapidity, that this catalytic power has been much studied and some practical applications made of it. The most satisfactory black dye for fabrics is aniline black, and this black is made by the oxidation of aniline hydrochloride with various oxidizing agents, potassium chloride being the commonest. In order to make the reaction proceed with sufficient velocity for commercial purposes copper salts were added. Lightfoot, an English dye works chemist, tried salts of various elements and found that many of them possessed the property of accelerating this reaction, and that copper was superior to all the elements except vanadium, but when they tried vanadium they found almost infinitesimal traces of this element would turn immense quantities of aniline solution into aniline black. Since that time this catalytic property of the salts of vanadium has been the subject of much study and it is quite unique. In addition to its application in dyeing it has been used in medicine and no doubt will find many other applications.

The only one of the compounds of vanadium which requires detailed description in such an article as this is the pentoxide. It exists in several modifications, a crystalline one which is almost insoluble in water, and two amorphous modifications, one of which dissolves in water, but with difficulty, and the other readily. This last solution is now thought not to be a true solution, but a colloidal one. This acid dissolves in concentrated sulphuric acid giving deep red solutions. When these solutions are diluted with water they turn green, owing to a partial reduction of the vanadium pentoxide to tetroxide. With concentrated HCl it forms green solutions and gives off chlorine, according to the equation:

$$V_2O_5 + 2HCl = H_2O + Cl_2 + V_2O_4.$$

In alkalies it dissolves and forms alkaline vanadates of which potassium vanadate, KVO_3 is a type. Ammonium vanadate is insoluble and ammonium metavanadate NH_4VO_3 is the commonest commercial salt of vanadium, and from it vanadium pentoxide is prepared by calcination.

Although a great deal of work has been done on the compounds of vanadium there still remain innumerable points to be cleared up, many of which would lead to remarkable improvements in the methods of extracting the metal from its ores, for the metallurgist who essays to invent a hydrometallurgical treatment for any of the vanadium ores to be found in America is continually hampered by the inadequate data regarding the reactions of the element. Up to the present only a few chemists have been in a position to obtain vanadium salts in large enough quantities to work with the element, but now that these salts can be got comparatively cheaply and of great purity, it is to be hoped some of the mysteries surrounding the chemistry of the element will be cleared up. There has also been a tendency to attribute an inherent waywardness to the reactions of this element. The author has often heard the remark made, "Well, if it wasn't vanadium we might expect such and such things, but no one knows what vanadium will do—it never does the same thing twice." Now, we all know that such talk, even if in fun, is wrong, for vanadium no less than any other element is amenable to ordinary laws of chemistry. Under the same conditions it will give the same reactions at all times and in all places. Only these reactions may be so complex that changes in conditions which would not interfere with the reactions of other more easily handled elements will here be of great importance, and this fact must be heeded. In the next section of this article we will deal with the metallurgical properties of vanadium, and with vanadium steels. A reference list of a few of the more important contributions to the literature of the subject is appended.

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TEMISKAMING.

President F. L. Culver sent out the following letter on July 19 to the shareholders of the Temiskaming Mining Co., Ltd.:

The following is a record of the development for six months ending June 30, 1915: Drifting, 1,740 ft.; crosscutting, 657 ft.; raising, 323 ft.; winzes, 85 ft.; total 2,805 ft.; stoping, 3,562 cu. yd.

In the old vein system, on the 350 ft. level, No. 3 vein, we have developed a large block of mill rock. Between the 400 and 500 ft. levels, vein No. 15 is from 1½ to 3 in. wide carrying high grade ore in places, and vein No. 2, south stope, is 3½ to 6 in. wide of good mill rock, with splashes of ruby silver and some smaltite. In the winze which was started from the 750 ft. level, sinking has been continued to a depth of 85 ft., 50 ft. of which carried ore. Drifting back under the shaft and raising, making a connection, will give the shaft a total depth of 835 ft. from the surface.

In the new vein system, on the 400 ft. level in drift No. 21, we have a vein 5 in. wide of 3,500 oz. ore. We have drifted on this toward the Beaver property 135 ft. and are now within 20 ft. of the Beaver line. Timbering is being done preparatory to stoping this ore when necessary. Ninety feet west of drift No. 21, we have encountered a calcite vein about 5 in. wide, but as yet no development work has been done on same. On the 500 ft. level, drift 21 is practically up to the Beaver line. The north breast stope shows five veins of rich ore each from 1½ to 2 in. in width and the country rock between these veins carries good milling values. The breast of the cutting out stope, No. 23 drift, is now 190 ft. south of the Beaver line and the vein carries high grade for this distance.

In order to carry out our policy of deep mining, it was found necessary to install a new hoist. This is being built by the Nordberg Manufacturing Company of Milwaukee and we expect to have it installed and running within sixty days. This hoist will enable us to reach the lower contact between the diabase and the Keewatin formations (a depth of between 1,600 and 1,700 ft.), and it is believed that as rich values will be encountered at the lower contact as have been developed at the contact above. This work will be pushed forward as rapidly as conditions will permit.

The contract which existed with the Northern Ontario Light and Power Company expired some little time ago and a new contract was submitted, the terms and conditions of which were not satisfactory, consequently we refused to sign the same. Quite a little discussion arose between the two companies; in the meantime, in conjunction with the Beaver Consolidated Mines we obtained figures as to what it would cost to install a plant to generate sufficient power to take care of both properties, should it be necessary to do so. However, arrangements have been made so that operations will be continued temporarily under practically the old conditions.

We have deemed it advisable not to sell our bullion at the present prices (the lowest for years) and are storing the same in London and New York, against which we can borrow money at any time to pay current expenses.

June 30, 1915—	ozs.
Bullion in storage	442,701.22
Due from smelters	187,568.90
Ore bagged at mine	100,000.00
Total	730,270.12
(Loan obtained on bullion security, May 8th, $30,000.)	
June 30th, 1915—	
Cash on hand	$223.69

GRANBY CONSOLIDATED.

Granby Consolidated Mining, Smelting & Power Company has entered upon what promises to be a record-breaking year. Its fiscal period ended June 30 last with improved operations and earnings, while since the first of July deliveries of copper at or near the highest prices have started.

The entire battery of eight furnaces at Grand Forks has been blown in and the Hidden Creek smelter has been tuned up to capacity, giving the Granby Company a monthly production approximating 4,000,000 lb. of copper.

In May the new Hidden Creek smelter commenced to show its speed. In that month it turned out for the first time more than 2,000,000 lb. of copper, besides an increasing amount of gold and silver. The old plant at Grand Forks also gave a good account of itself.

Granby's operations during the past few months have run as follows (lb. of copper):

	Grand Forks		Hidden Creek	
	1915	1914	1915	1914
January	775,786	1,793,840	1,349,353	.....
February	1,029,885	1,661,212	763,488	.....
March	1,196,670	1,775,852	1,597,022	.....
April	1,392,510	1,692,102	1,678,827	440,767
May	1,662,398	1,669,334	2,021,717	773,960

The entire smelter at Grand Forks was not in operation during the month of May, but with increased capacity began in June and [illegible] over the preceding month.

The fourth furnace, installation of which was started about six weeks ago, should be ready for operation [illegible] making available for steady run three sections of the Hidden Creek plant. This will add materially to the production from that source.

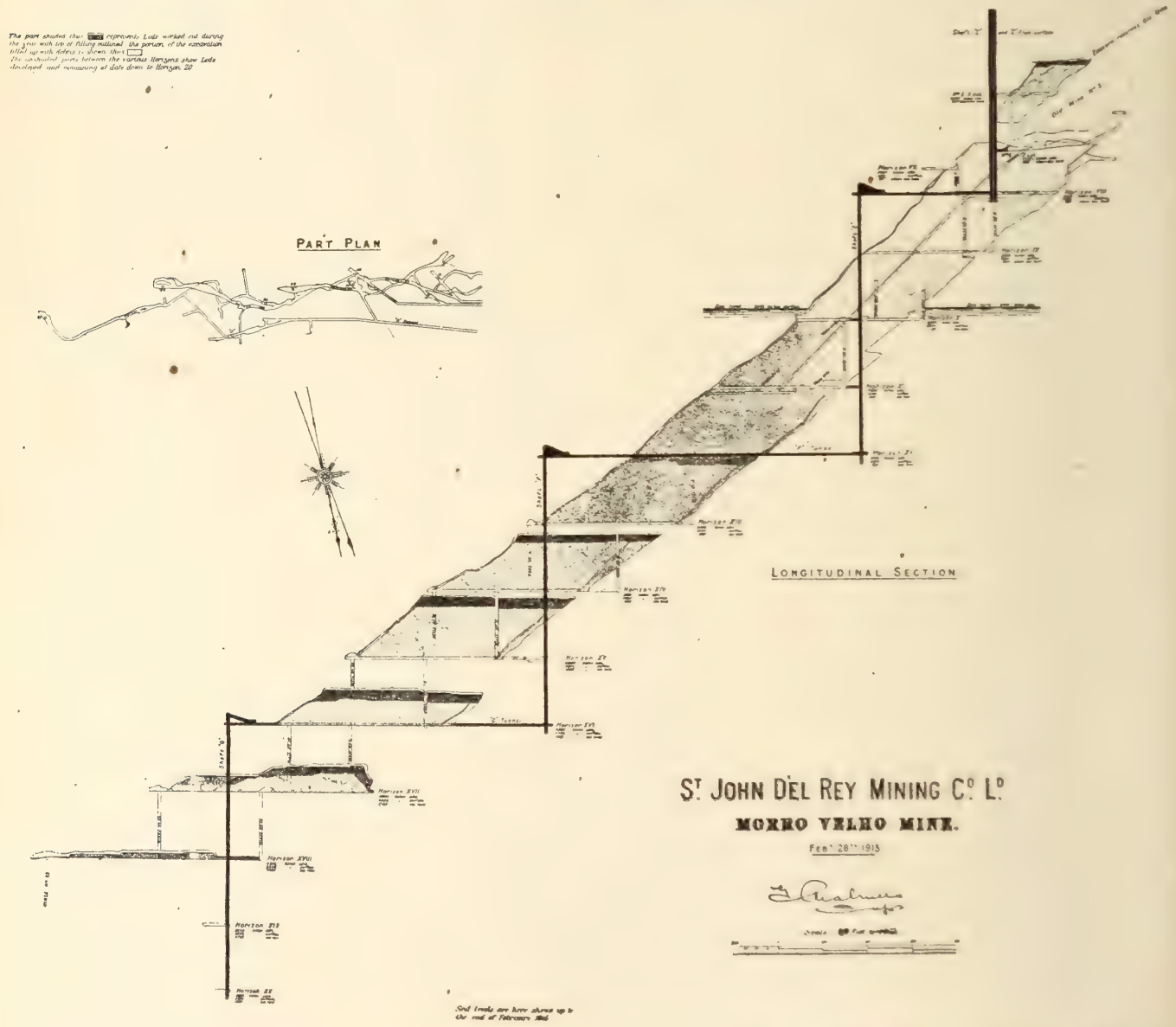
The agglomerator installed at the Hidden Creek smelter to recover copper from the dust should be a factor very shortly both in increasing the amount of copper production and in lowering costs.

The Mines mine at Mesa, upon which [illegible] work has been done to date, is developed on a productive lower shoot that could take [illegible] a month.—Boston News Bureau.

VENTILATING THE WORLD'S DEEPEST MINE

By G. Chalmers, Superintendent Morro Velho Mine, Brazil.

Investigations in connection with ventilation at the Morro Velho mine, of the St. John Del Rey Mining Co., Ltd., substantiate previous reports that the system of distribution of the air, although meeting the case satisfactorily and in a most economical manner in the past, is becoming, as greater depth is attained, defective, and requires modification. Even when on rare occasions the downcast air at the bottom of the mine is comparatively low in moisture, by the time it has passed over two horizons it has become saturated, partly from the watering of the ways to lay dust, the sweat from the bodies of workmen, and from the breath of the animals and men. Consequently the efficiency of the men on the stopes above must be considerably impaired; in fact, according to authorities on the subject, 86° wet bulb (which represents the conditions of, say, horizon 16, at any rate during the rainy season) is supposed to be the limit at which men can work with full efficiency, and as the mine deepens this will, of course, be more seriously felt. But by largely increasing the volume of air passing through the deepest explorations, and by leading the allotted quantity (after it has passed over the stopes of one horizon, or at the outside two) directly to the upcast and away to surface, instead of passing it over the stopes above as in the old and existing system, the best possible conditions will be obtained. Due to the fact of our now being in a much better position as regards the main-way into depth, namely, of its being in advance of the explorations, Captain Watts has proved that it is possible to work each block by one vertical winze only, and our calculations show that this one winze and a steel pipe of 3 ft. to 4 ft. in diameter, will, with the eastern paved air-way give ample ventilation to the stopes during the working out of a block of mineral. Consequently, one winze for mineral and filling to act as a temporary upcast, which during the working out of each block disappears as the mineral is removed, is sufficient for the mining operations, and by sinking another vertical winze from one horizon to the



other, never less than 50 ft. from the average line of the north wall of the lode, and some connecting tunnelling, a permanent return air-way will be formed at a cost no greater than that of the old system of working out each block with two vertical winzes and a western wood block air-way and the eastern paved air-way, as the large saving in the temporary western air-way in the form of a 3 ft. to 4 ft. steel pipe over the wood block air-way formerly used, is more than sufficient to pay for the tunnelling between the top of one permanent upcast winze and the bottom of the next, and that connecting the temporary winze with the permanent There is another advantage in this system, namely, that when it is completely established we have a second permanent way into depth from horizon 17 down. It was difficult to determine the point at which the improved system should commence, but for various reasons No. 23 winze offers the best opportunity for an independent upcast air-way, and consequently it has been decided that the new system should commence from this point.

The benefit of the proposed alteration in the ventilating system will not be felt on the blocks of mineral to be worked out from horizon 17 up, but from 17 down. Those of us who have been responsible for the re-opening of this mine from surface to its present depth of 5,826 ft. have had the opportunity of realizing the steady rise in temperature as the depth has increased and have been frequently reminded of the difficulties in store for the company, especially at such times when an inadequate volume of ventilating air had been passing over the stopes or through explorations, caused by the partial closing of air-ways, the failure of fans, or by the explorations progressing more rapidly into depth than the main ventilating system. However, for many years it was possible to keep down to a reasonable figure the temperature to which the miners were subjected, and it appeared that by increasing the volume this condition could be maintained.

Past and present methods of ventilating.—In the first place natural ventilation was sufficient, later, furnaces had to be adopted during the hot season to assist the natural ventilation. As the mine became still deeper a Capel fan was installed at the top of the upcast "C" shaft to ensure a more constant volume of air. Finally, a Sirocco fan of larger capacity was installed in place of the former, the output of which could be increased by additional power, when required. Besides this, auxiliary fans are used on all explorations beyond the main system.

The existing ventilating system, which is referred to above as not satisfactory at the present depth, was forced upon us at a time when a more elaborate one of an entire independent air-way from surface down, which naturally recommended itself, would have been too expensive. The former represented the cheapest means of ventilation, and until quite recently met the case satisfactorily, as long as the system and supply of air was not interfered with by the above-mentioned causes. However, as depth has been attained the necessity for modification in the distribution of the air becomes imperative if the mine is to be worked to a much greater depth of which there is every possibility, seeing that the lode has so far shown no signs of failure in size or value in the lowest explorations made upon it, and as also there is apparently no geological reason against its continuance in depth; and the prospects of this company being able to work it profitably to a great depth seem only to be limited by the measurable additions in cost of winding, hauling, handling, mineral and other engineering matters. All these increase a little more or less proportionally to the depth, with one exception, viz.: that of **increasing heat in depth, which has presented itself to our minds as by far the most important obstacle, that is to say, if it cannot be overcome by some satisfactory artificial means of cooling.**

It was in consequence decided some years back to institute investigations with the object of obtaining information as to the increasing air and rock temperatures and other factors that go to make against the miners' efficiency, and add to cost the deeper the mine is sunk. As regards the rock temperature, bore holes were made at the different horizons, or vertical depths, and the temperatures taken. For a considerable time, due to the holes being too shallow, or badly situated, and to our want of experience in the matter and somewhat unreliable instruments, our readings were only very approximate. Gradually, however, the conditions for performing this work were improved and our preliminary investigations from year to year went to show that **in spite of the increasing heat found at the moment of opening the rock the deeper we went, it gradually became cooler after it had been in contact with a current of ventilating air.** From the temperature readings we obtained of the rock at the moment of opening different horizons, we were able to construct a rock temperature grade as a guide to what we might expect in depth. Since then, other horizons in depth have been opened and our grade, as will be seen in the chart, agrees closely with the readings taken, with the exception of that at horizon 20, which is lower than it should be owing to the exceptional volume of ventilating air forced to that point by the auxiliary fans cooling down the rock before its real temperature could be taken.

As before stated, **without this rise in temperature from the rock and other causes, the probable running engineering expenses in working the mine down would not mean a very serious increase, and this has proved itself in practice as far as we have gone.** Supposing the lode continues the same in size and value to horizon 26 (a vertical depth of 7,626 ft.), it could be worked profitably to that point and even to a much greater depth, but from the grade on our temperature chart, the rock at horizon 26 would be no less than 126.5° Fahr. at the moment of opening, and supposing that the mine atmosphere derived from an abundance of air from surface were maintained, the very best result we might expect as regards temperature would be that represented by the black dotted line A on the chart, which we considered in the past showed probably the lowest limit of mean air temperature that could be attained after the workings were connected with the main ventilating system, as experience proved in the upper sections of the mine that that atmosphere had gradually cooled down a little more or less to that line. We have, however, of late realized from practice that the best we can now expect in the manner of artificial cooling would be as represented by the black line, which means that we are nearing a point where the efficiency of the men would be affected.

It will be seen from the chart that the rock that had been laid open and exposed to the ventilation for some time past by some fall or some natural cause will be apparent that the danger of heat, the cooling effect of the ventilating air would become less effective as we went lower in the rock, especially considering the rock area, but beyond certain reasonable limits we could

not increase the volume of the air, and consequently **unless the air could be artificially cooled on surface, advantage being taken of the operation to deprive it of some of its moisture, the possibility of working the mine to horizon 26 would be small,** unless the working hours were reduced by the introduction of four shifts in the place of three, which would not only mean a large direct increase in labor cost, but necessitate addition in house accommodation and other matters representing a serious item in an isolated place of this kind where all work is so costly. It was accordingly decided to make further efforts in obtaining more reliable information as regards this important question so as to arrive at the most economical and efficient means of reducing both the temperature and moisture of the atmosphere within the mine. We considered that the temperatures shown on the chart, although not absolutely accurate, were near enough as a guide for all practical purposes. **The increase of air temperature due to the air becoming more dense as it passes down the mine, as explained by authorities on the subject, and checked by us, showed under normal conditions an increase of 1° Fahr. for every 180 ft., whilst the increase in rock temperature is approximately 1° Fahr. for every 125 ft.**

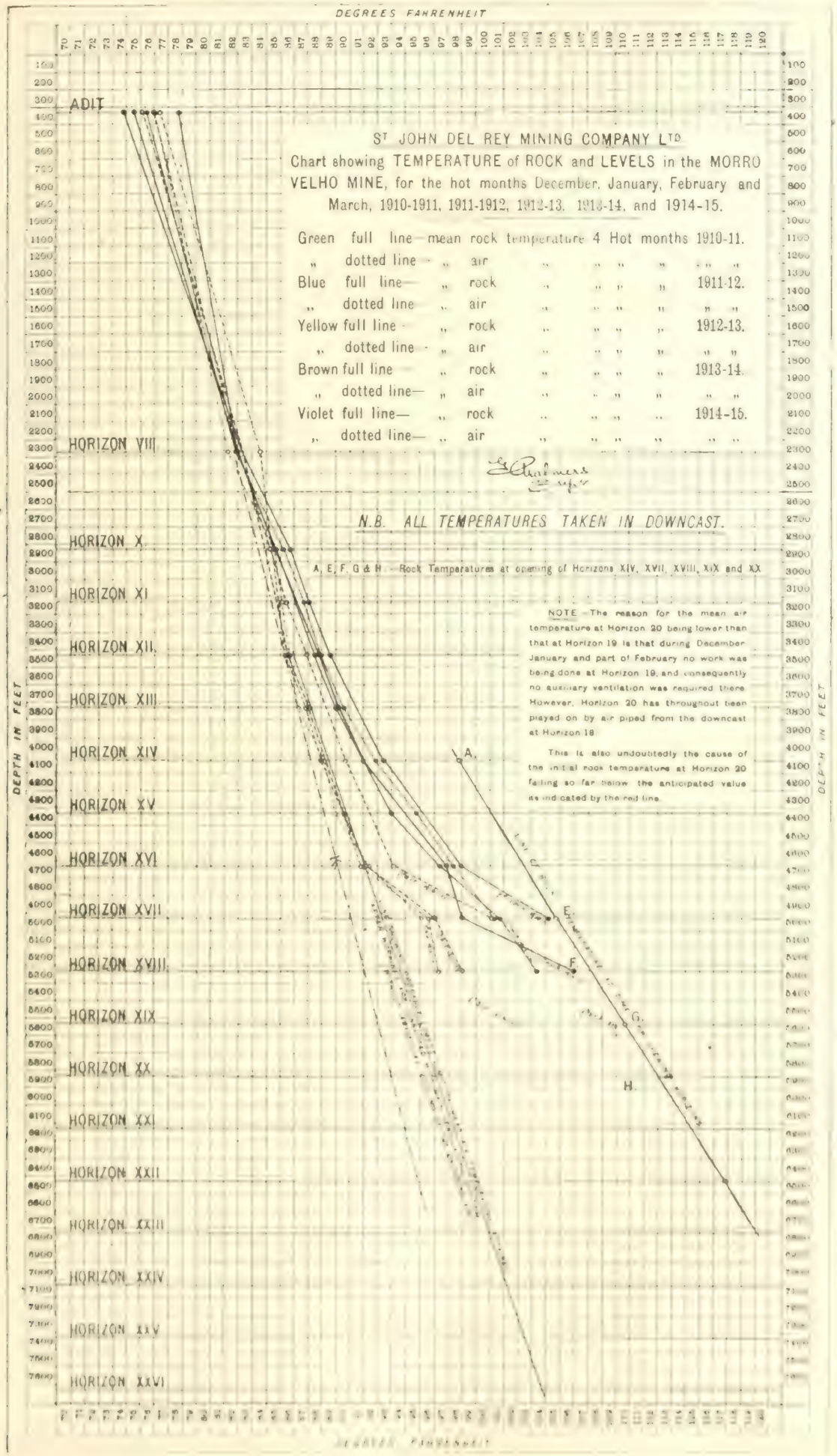
There are many other causes for increase in temperature in the mine, viz., those due to the friction of the air, heat from machinery, lights, decomposition of mineral, heat from the bodies of men and animals, etc., but the heating effect from the rock, and that due to the compressing of the atmosphere as it descends into depth, are, in the case of this mine, the most serious, and it is evident that unless the air as it enters the mine is made considerably cooler than the average surface temperature, it would in descending into depth arrive at a point below the present bottom, where its temperature would not allow men to work. But if the air entering the shafts can be cooled to something very considerably below that of the normal atmosphere, and the supply is abundant and constant, the rock will be progressively cooled from surface down, and, as time goes on, the cooling by air will be more effective in the bottom of the mine than at the time of starting the plant. During the cold season an experiment was tried by night, when the temperature was considerably below the normal, in which a known volume of air was passed through a measured distance of the adit tunnel into the mine, the rock temperatures being taken throughout the distance of the tunnel and period of trial, and at the end of five hours it was interesting to find that a considerable fall in the rock temperature had taken place, and it would no doubt have continued to do so to some extent had it been possible to maintain a supply of cool air (which would be the case if artificial cooling were adopted; but as soon as the sun rose, the air became warmer and the rock rose again to its original temperature.

As before stated, **the drying of the air has always been considered necessary in conjunction with the cooling operation,** but its importance was not so fully understood until information was gained from a valuable paper by Professor John Cadman, and the writings of other authorities on the subject had come to our notice. Unfortunately, the drying of the atmosphere is somewhat antagonistic to a satisfactory solution of the dust question, which necessitates watering of the roads and stopes to keep down the dust. However, the proposed distribution of the air, previously referred to, will apparently do far more to overcome the dust trouble than the drying of the air will make against our efforts in this respect, as the allotted quantity of air, after passing one stope, or at the outside two, will go directly with what dust it has taken up to the upcast and away to surface, instead of the present system in which the same air passes the bottom stopes, from thence over the remaining stopes, with some slight addition of fresh air at each horizon, but accumulating dust all the way, until it finally reaches the highest stope, and from thence goes to surface.

The actual necessities as regards cooling and drying to ensure that as greater depth was attained the miners would work in a perfectly healthy atmosphere (even more so than in the upper sections) having been appreciated, the next point to determine was where the operation of cooling and drying should take place. Some advice had been offered to the effect that it would be most advantageous underground, and it is true that some benefit would be derived from this; but the increase in mechanical appliances underground represents a serious obstacle to our particular form of mining operations, and, further, on account of our principal cooling agent (water) being found on surface in abundance, whilst underground there is very little, and that at a high temperature, it has been decided that the cooling plant should undoubtedly be installed on surface—namely, at the top of the "D" downcast shaft.

Mr. Eric Davies, whose duty it has been to carry out the investigations, has also been entrusted with the designing of a plant which we consider most suitable for the purpose, and careful study has led to the proposing of this plant, not for extreme cooling or drying of the air, but one in which each operation will be performed to the most economical point, at the same time making use of ordinary cooling appliances which in practice have long since proved their reliability in cold storage dry blast for furnaces and other installations, and in consequence it represents a thoroughly practical scheme, which will effectually remove the one serious obstacle against the company being able to work the mine to a great depth. It will, however, be placed before specialists on cooling installations before it be finally determined upon. As regards the necessary power for driving the plant, this is not excessive, amounting to approximately 400 h.p., and as to the provision of this power, with that of 200 h.p. for ventilation, and other additions necessary for the working into depth, it has been satisfactorily arranged for.

The mine captain considers the efficiency of the miners is very little affected so far, and the writer is inclined to think that men who have been used to the damp, hot climate of Brazil for some years are probably more capable of working efficiently in 86° wet bulb temperature than men in England accustomed to a damp, cold climate on surface. Often enough in the hot season here the change from surface to the bottom of the mine is only slight, but the change in England would of course be a far more severe trial. Even in the hottest places in the mine the contractors are eager to work twelve hours, and had it not been for our complying with this to some extent, we should have lost our men. It is, however, evident that in spite of the apparent possibility that this climate is favorable to the efficiency of men working in hot mines, eight hours is quite sufficient for steady workers at the present depth.


DEGREES FAHRENHEIT
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HORIZON VIII
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HORIZON XXII
HORIZON XXIII
HORIZON XXIV
HORIZON XXV
HORIZON XXVI
ST JOHN DEL REY MINING COMPANY LTD
Chart showing TEMPERATURE of ROCK and LEVELS in the MORRO VELHO MINE, for the hot months December, January, February and March, 1910-1911, 1911-1912, 1912-13, 1913-14, and 1914-15.
Green full line—mean rock temperature 4 Hot months 1910-11.
„ dotted line— „ air „ „ „ „ „ „
Blue full line— „ rock „ „ „ „ 1911-12.
„ dotted line— „ air „ „ „ „ „ „
Yellow full line— „ rock „ „ „ „ 1912-13.
„ dotted line— „ air „ „ „ „ „ „
Brown full line— „ rock „ „ „ „ 1913-14.
„ dotted line— „ air „ „ „ „ „ „
Violet full line— „ rock „ „ „ „ 1914-15.
„ dotted line— „ air „ „ „ „ „ „
N.B. ALL TEMPERATURES TAKEN IN DOWNCAST.
A, E, F, G & H—Rock Temperatures at opening of Horizons XIV, XVII, XVIII, XIX and XX
NOTE—The reason for the mean air temperature at Horizon 20 being lower than that at Horizon 19 is that during December, January and part of February no work was being done at Horizon 19, and consequently no auxiliary ventilation was required there. However, Horizon 20 has throughout been played on by air piped from the downcast at Horizon 18.
This is also undoubtedly the cause of the initial rock temperature at Horizon 20 falling so far below the anticipated value as indicated by the red line.
A.
E.
F.
G.
H.

CHART SHOWING TEMPERATURE OF ROCK AND AIR AT DEEP LEVELS

MINING IN NEWFOUNDLAND

By J. W. McGrath.

Newfoundland wherever known is famed for her fisheries. Few have ever regarded her as a mining country, and yet, strange as it may seem, two of the richest copper and iron mines in the world have been worked for years there.

No one ever made scientific explorations to ascertain what minerals may exist in Newfoundland. That minerals were discovered at all was by mere accident. It was by mere chance that the copper deposits at Tilt Cove, and the iron deposits at Wabana were discovered.

Several years ago, in 1857 to be exact, a prospector for minerals, Mr. Smith Mackay, was engaged searching for mineral ores around the Newfoundland coast. The route of his travel led him to a village named Tilt Cove, where five or six families supported themselves by fishing. During his stay over the night at one of these fishermen's huts Mr. Mackay was surprised to find a large yellow colored rock, which rested as an ornament on the mantleshelf. On enquiry Mr. Mackay was told that the stone was taken from a large yellow cliff near by. The cliff when examined was recognized to be a great deposit of copper ore. On quantitative analysis being made the samples averaged about twelve per cent. copper alone. A mine was opened up, and the annual yield ever since has averaged fifty thousand tons, valued at approximately one quarter of a million dollars. In the contiguous village of Betts Cove, another deposit was later discovered, and with intervals has been worked ever since.

Over the whole district where these two mines are located, copper ores have been found in almost every village.

All around the coast and on the smaller islands around indications of copper may be observed, even extending to the coast. The writer has copper ore taken two years ago on Southern Labrador, which when analyzed yielded 28 per cent copper. The Newfoundland Government recently enacted a measure allowing bounties on copper ore smelted of 3½ per cent. on a sum not to exceed $50,000 for any one company owning annually for twenty years. All these lodes of copper ore are on tidal waters; what the interior of the country will reveal in mineral values is yet a closed book.

The other great mine of Newfoundland is the iron mine of Wabana. Here rests one of the greatest known deposits of iron ore in the world. The discovery of this ore was also merely accidental and happened in this way: The large and heavy red stones found along the beaches of the little village of Wabana had always provided very suitable ballast for fishing craft. On one occasion they were displaced for goods and left on one of the piers at St. John's; there they remained till a chance analyst disembarking from a steamer espied the stones, and judged them to be metalliferous.

Wabana is one of three islands occupying the centre of Conception bay and lies a little over five miles from the mainland, and here more than a million tons of hematite iron is yearly mined.

The ore exists in large bands, of which there are twelve, ranging in thickness from one to ten feet. First operations were begun here in 1895 by the Nova Scotia Steel Company, which worked alone for four years. In 1899 this company sold a portion of its claims, representing 28,000,000 tons of ore, to the Dominion Steel Company, for one million dollars.

Every year since both these companies have vigorously operated, five hundred thousand tons being annually mined by each company. Up-to-date apparatus has recently been installed for loading the ore boats, and one with a carrying capacity of fourteen thousand tons is easily loaded in a day.

The ore mined by the Dominion Iron and Steel Company is sent to its smelters at Sydney, Cape Breton. The output from the Nova Scotia mine always found a ready market in Germany, and undoubtedly much found its way to the great Krupp works. A large portion of this ore is submarine, and ore has been already mined for a distance of three miles out under the Atlantic.

Professor Howley has computed that the grand total of iron ore in all the bands now known to exist at Wabana, reaches the enormous amount of 3,635,543,360 tons. He says: "The amount that may be recoverable will largely depend upon the conditions met with, the engineering skill to cope with any difficulties that may present themselves, and the adequacy of the machinery employed to keep the mine dry and fully ventilated."

Mr. Moxham, a famous American iron and steel expert, declared that "at the Wabana mines the actual price of mining and putting the ore on cars is less than the usual contractor's price for the removal of earth, in fact the ore is capable of being mined as cheap as dirt."

At the present time these two companies employ a staff of about fourteen hundred men.

It is a matter of some significance that the only two mines being worked in Newfoundland, two of the largest of their kind in the world, came into operation merely by chance.

Reports have been current at Spokane, Washington, to the effect that some prominent mine-owners operating at Burke, Coeur d'Alene district, Idaho, have secured control of the smelting works at Northport, Washington, and that they will establish there a lead-smelting industry. The Northport smeltery was built in the late nineties by Spokane men then largely interested in the Le Roi gold-copper mine at Rossland, B.C., chiefly to treat Le Roi ore. The British company that afterwards acquired the Le Roi mine also eventually purchased the smelting works, and until the suspension of mining by the Le Roi Company operated the works, smelting both Le Roi and custom ores. The Coeur d'Alene mine owners, now stated to have decided to commence smelting lead ores at Northport, are reported to have failed to agree upon a smelting rate satisfactory to them, with the large smelting company that has heretofore smelted their ore, so are arranging to smelt their mine product at reduction works under their own control.

Shipment of zinc ore and concentrates from mines in the Slocan district of British Columbia during the month of June are stated by the Nelson Daily News to have totalled 451 tons, as compared with 573 tons in the corresponding month of 1914. The chief shippers this June were the Surprise and Hewitt mines, while in June of last year the Standard mine sent out 541 tons, but not any during the corresponding month of this year. However, the Standard concentrator is now being operated, so shipment of zinc as well as lead concentrate will be resumed as soon as a suitable market shall be found for the former.

Canadian Mining Institute---Western Branch

The twentieth general meeting of the Western Branch of the Canadian Mining Institute was held at Rossland, British Columbia, on July 15. In the unavoidable absence of Mr. S. S. Fowler, chairman of the branch, Mr. M. E. Purcell, superintendent of the Centre Star group of mines, presided at the two sessions held.

At the morning session those present were welcomed first by the Mayor of Rossland, and next by Mr. Lorne A. Campbell, district representative in the Provincial Legislature.

After acknowledgments by the chairman, Mr. E. Jacobs read some notes on the Mineral Production of British Columbia in 1914, first dealing briefly with the province as a whole, and then giving some information relative to the proportion contributed by Rossland mines in particular, in regard to which he showed that while the value of the mineral production of the whole of West Kootenay district in 1914 was $6,311,205, the proportion of Trail Creek mining division—almost altogether from Rossland mines—was $3,456,610, or 53 per cent. of the whole. Further, the total value of the mineral production of West Kootenay for five years, 1910-14, had been $29,000,665, of which the proportion of Trail Creek division had been $15,835,094, or a little more than 54 per cent. As showing how important a position Rossland mines hold in the lode gold production of British Columbia, it was shown that out of a total of 1,273,238 oz. produced in the province during five years, 1910-1914, Rossland mines contributed 643,605 oz., or a little more than one-half.

Mr. L. A. Campbell spoke on the subject of "**Underground Lighting in Mines,**" dealing especially with coal mines, for which he advocated the use of the storage battery lamp. Carbide lamps as compared with candles underground in metal mines were discussed by Mr. Ernest Levy, manager for the Le Roi No. 2, Ltd., and Mr. D. Michell, of the Provincial Department of Mines, while the secretary mentioned the experience of the superintendent of the Hedley Co.'s gold mine, and read some notes by Mr. C. M. Campbell, superintendent of the Granby Co.'s copper mines at Phoenix, Boundary district, where carbide lamps had been found much more economical than candles.

A paper on "General Gold-Silver Milling Practice and Tendencies," by Mr. Chas. A. Banks, general manager for the Jewel-Denero Mines, Ltd., Greenwood, B.C., was read by the secretary, and was briefly discussed.

Evening session.—Dr. Chas. W. Drysdale, of the Geological Survey of Canada, read a paper in which he described the occurrence of molybdenite at Lost creek, Nelson mining division, and showed samples of the mineral he had obtained from the property which he examined last summer.

Mr. Dudley Michell gave particulars of the [illegible] that had been formed at metalliferous mines in Kootenay and Boundary districts during the year that had elapsed since he commenced organizing them in the summer of 1914; also the number of oxygen-breathing apparatus and pulmotors now at the metal mines of the province and available for use in cases of emergency, and the number of men who had been trained in their use. Discussion followed in which Messrs. E. Levy, M. E. Purcell and E. Jacobs took part.

Mr. Levy gave some diamond drill costs at the Josie mine of the Le Roi No. 2, Ltd., Rossland, as follows: For 14,185 ft. in 1912, $1.69 a ft.; for 15,075 ft. in 1913, $1.67 a ft.; for 12,249 ft. in 1914, $1.64 ft. Questions were answered by Mr. Levy, who is of the opinion that diamond drilling by contract at other mines in Rossland camp has cost the mine owners more than drilling had cost the Le Roi No. 2, Ltd., in its mine.

There was some discussion relative to **Unworked Crown-granted Mineral Claims,** in the course of which parts of Mr. Norman R. Fisher's paper entitled "Stalemate in the Mining Industry of Ontario and its Remedy," published in the Monthly Bulletin of the Institute for May last, were read by the secretary, who also mentioned a paper on "The Paralysis of Mining Districts," presented by Mr. Edmund B. Kirby at the session of the American Mining Congress held at Goldfield, Nevada, in 1909. While the desirability of having mineral claims worked was admitted by all, some of the speakers presented the owners' side of the question. It was agreed that while the matter is not one in connection with which hasty action would be wise, there seemed to be a general feeling that there must eventually be a change in the direction of providing for working claims within easy reach of transportation and other facilities for mining.

Other subjects discussed were "Mining Camp Conditions" and "Technical Education at Night Classes in Mining Districts." In connection with the former, the advantages enjoyed by miners working in such camps as Rossland and the Bluebell on Kootenay lake, and provided by mine owners as well at the Nickel Plate mine in Camp Hedley, and the Britannia mine in Vancouver mining division, were pointed out, and the need for effort to improve conditions in mining camps where similar advantages are not enjoyed by the miners, was emphasized.

It was announced that the result of the ballot for chairman of the branch for the ensuing year had been the almost unanimous election of Mr. Thomas Graham, of Victoria, chief inspector of mines, there having been only one vote for another member.

First Aid and Mine-rescue.—On the afternoon of Friday, July 16, a team of miners from the Centre Star mine gave a demonstration of "First Aid to the Injured," and of Mine-rescue work. In connection with the latter, an empty store on Rossland main street was used as a smoke chamber, and the team wearing [illegible] rescued a supposed injured and asphyxiated miner and restored him by [illegible] on supposed injured limbs before carrying him off to the hospital. This demonstration was watched with much interest, being the first of the kind in any metal mining camp in the province.

AN AUSTRALIAN METAL EXCHANGE

Melbourne, July 21.

An Australian metal exchange is to be established. This step will be taken at once, as Andrew Fisher, the Attorney-General, told the House of Representatives to-day, to bring to an end German influence regarding the disposal of Australian metals.

W. M. Hughes, the acting Premier, declared that the metal market was dominated by Germans, who, he said, had "filched Great Britain to the extent of millions of pounds sterling."

ONTARIO NICKEL COMMISSION

Hon. G. Howard Ferguson, Minister of Lands, Forests and Mines, has announced the personnel of the Government commission that is to investigate the nickel situation in Ontario in relation to conditions created by the war, and with a view to establishing in the province an industry to turn out nickel as a finished product.

The chairman of the commission, who was recommended to the Ontario Government by the Imperial authorities, is George T. Holloway, A.R.C.S., of London, Eng., and associated with him will be Willett G. Miller, M.A., LL.D., F.R.S.C., the provincial geologist; McGregor Young, M.A., K.C., of Toronto, and Thomas W. Gibson, Deputy Minister of Mines.

The chairman of the new commission is now in England, where, at the request of the Government, he is making certain investigations and consulting with the Imperial authorities to secure their views in relation to the nickel requirements of the Government, and to the future policy of the Ontario Government with reference to the export of nickel. The other members of the commission are already engaged upon preliminary work. It is expected that the investigations of the commission will take close upon a year. During that time the commission will probably visit England and Norway, the latter country in order to look into a new electrical process for refining nickel that, it is thought, may be practicable in Ontario. The commission will also visit the New Caledonia mines in the South Seas in order to get first-hand knowledge of the quality and extent of the nickel ore bodies there. The New Caledonia ore fields are second to those of Ontario, but at present unable to compete to any extent. The purpose of the commission will be to determine what competition Ontario nickel will meet from this source if refining in Ontario raises the cost of the home products.

Creighton Nickel-Copper Mine

"While satisfactory assurances have been given to the Imperial authorities and the Dominion and Provincial Governments as well that none of Ontario's nickel is finding its way to the enemy, the Government views the situation from a larger standpoint," stated Hon. Mr. Ferguson, "and the commission will ascertain whether it is not possible to complete the refining of

Mining Nickel-Copper Ore, Creighton Mine

nickel ore from the mines of Ontario entirely within the province. The question of the province receiving an adequate return from its nickel deposits is also regarded as of much importance, and on this point the commission will also advise the Government.

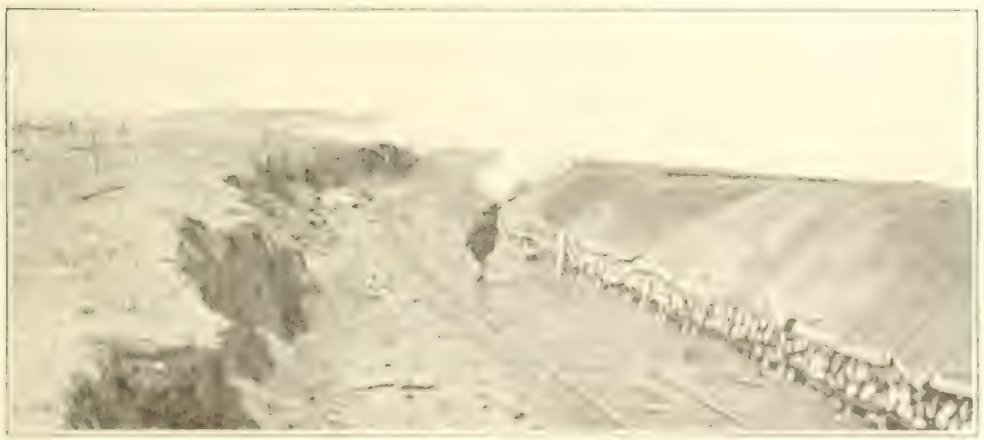
"Our idea was that the interests of the Province of Ontario in this question were so linked up with those of the Imperial Government that we should not proceed without consulting them. Accordingly, after the Government reached the decision to appoint a commission we got into communication with the Imperial authorities and asked that they recommend a competent metallurgist, who might be chairman of the board. The time consumed in official correspondence has been responsible for the passing delay, but as soon as the decision of the Imperial authorities was announced no time was lost in naming the remaining members of the board."

George Thomas Holloway, chairman of the commission, is an associate of the Royal College of [illegible] London; metallurgist and chemist, examiner in metallurgy, Institute of Chemists and University of Birmingham; vice president, Institute of Mining and Metallurgy, London. In addition to holding several fellowships, he is also a member of the Chemical, Metallurgical and Mining Society of South Africa, [illegible] the Franco-British and other exhibitions, and is adviser to the Egyptian Government.

Prof Willet G. Miller is regarded as the leading authority on the geology of Ontario and has rendered notable public service in working out the formations in various parts of the province. In recognition of his scientific services, he was awarded the gold medal of the Institution of Mining and Metallurgy, London, early this year, which was presented to him a short time ago.

James McGregor Young, M.A., is professor of constitutional law and international law at Toronto Uni-

Nickel-Copper Ore on Wind for Roasting



Roast Heaps Nickel-Copper Ore, Copper Cliff

Pouring Slag from Nickel-Copper Furnace

graph from a letter from Sir George Perley, Acting High Commissioner in London, who acted for the province in the negotiations: "I should like to add," said Sir George, "that very thorough steps were taken to obtain the name of a suitable man, and, in addition to making inquiries in other likely quarters, the Institute of Metals was approached. As a result, Mr. Holloway was recommended as eminently suitable for the position. I thereupon wrote Mr. Bonar Law submitting Mr. Holloway's name, and requesting that, before their decision was given, a careful investigation might be made as to his qualifications. Accordingly, at my instigation, the Colonial Office consulted the Admiralty, and ultimately advised me that their enquiries entirely bore out the opinion of the Institute of Metals that Mr. Holloway is a very suitable nominee for the position."

At the last session of the Legislature $15,000 was set aside to finance the investigation. The total outlay, however, will necessarily be much in excess of this sum.

RADIUM FROM CARNOTITE

Washington, July 27.

Secretary of the Interior Franklin K. Lane announced to-day that the production of radium from Colorado carnotite ores by the U. S. Bureau of Mines, in connection with the National Radium Institute, has passed the experimental stage in its new process and is now on a successful manufacturing basis. He also declared that the statements made to Congress concerning the ability of the Bureau of Mines to produce radium at a greatly decreased cost over other processes had actually been accomplished and that the costs were even less than predicted.

"The cost of one gram of radium metal produced in the form of bromide during March, April and May of the present year was $36,050. I am informed by Dr. Charles L. Parsons, in charge of the radium investigations of the bureau. This includes the cost of ore, insurance, repairs, amortization allowances for plant and equipment, cost of Bureau of Mines co-operation, and all expenses incident to the production of high grade radium bromide. When you consider that radium has been selling for $120,000 and $160,000 a gram, you will see just what the Bureau of Mines has accomplished along these lines.

"The cost of producing radium in the small experimental plant during the first few months of the bureau's activities was somewhat higher, but not enough to seriously effect the final average.

"The public, however, should not infer that this low cost of production necessarily means an immediate drop in the selling price of radium. The National Radium Institute was fortunate in securing through the Crucible Steel Company the right to mine ten claims of carnotite ores belonging to them and this is practically the only ore available at the time. Since then new deposits have been opened, but these are closely held, and according to the best judgment of the experts employed by the Bureau of Mines the Colorado and Utah fields, which are much richer in radium bearing ores than others known, will supply ore for a few years only at the rate of production that obtained when the European war closed down the mines. The demand for radium will increase rapidly, for the two or three surgeons who have a sufficient amount of this element to entitle them to speak from experience are obtaining results in the cure of cancer that are increasingly encouraging as their knowledge of its application improves. A few more reports like that presented to the American Medical Association at its recent San Francisco meeting and the medical profession as a whole, will be convinced of its efficacy. Under all the circumstances that have come to my knowledge it does seem to me that it behooves the Government to make some arrangement whereby these deposits, so unique in their extent and their richness, may be conserved in the truest sense for our people, by extracting the radium from the ores where its now lies useless and putting it to work for the eradication of cancer in the hospitals of the Army and Navy and the Public Health Service.

"The ten carnotite claims being operated at Long Park, Colorado, by the National Radium Institute have already produced over 796 tons of ore averaging above two per cent. uranium oxide. The cost of ore delivered at the radium plant in Denver has averaged $81.30 per ton. This included 15 per cent. royalty, salary of Bureau of Mines employees, amortization of camp and equipment, and all expenses incident to the mining, transportation, grinding and sampling of the ore.

A concentrating plant for low grade ores has been erected at the mines and is successfully recovering material formerly wasted. Grinding and sampling machinery has been installed at Denver and a radium extraction plant erected in the same city. The radium plant has now a capacity of three tons of ore per day, having been more than doubled in size since last February. Before that time the plant had been run more or less on an experimental scale, although regularly producing radium since June, 1914. To July 1, slightly over three grams of radium metal had been obtained in the form of radium barium sulphate containing over one milligram of radium to the kilogram of sulphates. The conversion of the sulphates into chlorides and the purification of the radium therefrom is easily accomplished and with very small loss of material. Unfor-

tunately, however, special acid proof enamelware, obtainable only in France, has not been delivered of sufficient capacity to handle the crystalization of the full plant production, so that a little less than half the output, or to be exact, 1,304 milligrams of radium element have been delivered to the two hospitals connected with the National Radium Institute. The radium remaining can be crystalized at any time from neutral solution in apparatus already installed, but the greater rapidity and efficiency of production of this very valuable material by the methods used have led the Bureau of Mines to await the completion of apparatus now being built before pushing the chloride crystalization to full capacity.

"The average radium extraction of all ore mined by the National Radium Institute has been over 85 per cent. of the amount present in the ore as determined by actual measurement. The amount present in the ore has been found in fact to be essentially the same as the theoretical amount required by uranium-radium ratio. The extraction figures for the last five carloads of carnotite treated has shown a recovery of over 90 per cent. in each case.

"A bulletin giving details of mining, concentration and methods of extraction is being prepared by the U. S. Bureau of Mines and will be issued early in the fall."

LABOR ORGANIZATION IN CANADA, 1914.

The fourth annual report on Labor Organization in Canada, containing 238 pages, embodying statistics, etc., for the calendar year 1914, has been issued by the Department of Labor.

Many will find a special interest in the chapter containing a discussion of the bearing of the European war on various aspects of trade unionism, which includes also the text of deliverances of representative labor organizations in different countries with respect to war in general or having special reference to the present war. Figures are printed showing the number of members of trade unions, who, to the close of the year 1914, have as recruits or reservists gone to the front from Canada. The trade unions furnished in all 3,498 recruits and 417 reservists, these figures not including recruits joining the forces since January, 1915.

The effect of the war on Canadian trade union growth is shown in a decrease of membership, the loss being 9,656. The estimated numerical strength of organized labor in Canada at the close of 1914 stood approximately at 166,163. The membership for each of the past four years, as reported to the Department, has been as follows:

1911.	133,132
1912.	160,120
1913.	175,799
1914.	166,163

The membership for 1914 of international organizations operating in Canada was 140,182; members of non-international bodies numbered 20,935, and 4,746 belonged to independent unions.

The decrease in international membership was 9,093 and in independent unions 1,261, while the non-international membership shows a gain of 720. At the close of the year 1914 there were 2,003 local branch unions in Canada, 1,174 owing allegiance to international organizations, 196 affiliated with non-international bodies and 33 independent unions. These figures show a reduction of 18 in local branches of international organizations, a loss of one in independent units, and a gain of five in non-international branches, making a total decrease of 14 in the number of local union branches in the Dominion.

A chapter is devoted to a discussion of some of the leading features of the organizations composed of workmen employed in the mining industry, including a brief history of their development and difficulties.

The report serves as a directory of trade unions for the Dominion for 1915, including as it does particulars not only of every known local trade union in Canada, but also a list of all international and non-international central organizing bodies, together with the names and addresses of the chief executive officers.

INTO BATTLE

By J. G., in "The Times."

The naked earth is warm with Spring,
And with green grass and bursting trees
Leans to the sun's gaze glorying,
And quivers in the sunny breeze;

And Life is Color and Warmth and Light,
And a striving evermore for these;
And he is dead who will not fight;
And who dies fighting has increase.

The fighting man shall from the sun
Take warmth, and life from the glowing earth;
Speed with the light-foot winds to run,
And with the trees to newer birth;
And find, when fighting shall be done,
Great rest, and fullness after dearth.

All the bright company of Heaven
Hold him in their high comradeship,
The Dog-Star and the Sisters Seven,
Orion's Belt and sworded hip.

The woodland trees that stand together,
They stand to him each one a friend;
They gently speak in the windy weather;
They guide to valley and [illegible]

The kestrel hovering by day,
And the little owls that call by night,
Bid him be swift and keen as they—
As keen of ear, as swift of sight.

The blackbird sings to him, "Brother, brother,
If this be the last song you shall sing,
Sing well, for you may use one another
Brother, sing."

In dreary, doubtful, waiting hours,
Before the brazen frenzy starts,
The horses show him nobler powers;
O patient eyes, courageous hearts!

And when the burning moment breaks,
And all things else are out of mind,
And only Joy of Battle takes
Him by the throat, and makes him blind,

Through joy and blindness he shall know,
Not wholly taught to know that still
Nor lead nor steel shall reach him, so
That it be not the Destined Will.

The thundering line of battle stands,
And in the air Death moans and sings;
But Day shall clasp him with strong hands,
And Night shall fold him in soft wings.

London, April, 1915.

SMELTING WITH CRUDE PETROLEUM*

By Allan Bruce Marquand.

The investigations recorded in the following thesis apply principally to a general problem in metallurgy, namely, the elimination of sulphur dioxide and the control of flue dust in the smelting of base metal ores; but they also include the examination of a new furnace by which it is hoped this problem is to be solved, to determine its adaptability for this and other purposes as will appear later.

The two products of the present day smelter, sulphur dioxide and flue dust, have of late excited wide attention chiefly because of their deleterious effect upon vegetation and cattle in the vicinity of reduction plants and also because their production causes considerable loss to the operators themselves. Various plans have been suggested to control the flue dust losses and of these the "bag houses" seem to have met with the greatest success, although even this installation presents many objectionable features; but as yet no one has succeeded in eliminating the sulphur dioxide fumes.

Process.—The process used in this series of experiments was suggested by J. Heslewood and his son Wm. Heslewood, the inventors. Extended investigations with a somewhat similar furnace were carried on at Herault, California, and a brief description of the methods of operation and results obtained follows:

The ore is both desulphurized and smelted in one double compartment shaft furnace so arranged that after desulphurization has been carried to the desired point in the upper compartment the ore is dropped to the lower compartment and there smelted. Crude oil fuel is used for the double purpose of supplying heat and an important chemical reagent—hydrogen. Steam is admitted to both compartments to control the temperature in the desulphurizing zone and to furnish hydrogen and oxygen in both zones. The resulting furnace atmosphere is decidedly reducing; its nature being determined by the relative amounts of oil, steam and air admitted. The product passing from the desulphurizing into the smelting zone ranges from 6 per cent. to 8 per cent. sulphur.

The smelted products are slag to be rejected and a matte to be later converted. The passage of gases through the charge is due to a vacuum draught generated by a water-jet pump consisting of a centrifugal pump discharging through an especially designed vacuum chamber into a tank as shown in the illustration. Here all solid particles and substances which are condensed at this temperature are precipitated as the gases rise through the water. This solid material will be largely sulphur and unburned carbon, while the true gaseous products consist chiefly of carbon dioxide, some carbon monoxide, a perceptible percentage of hydrogen sulphide, a trace of sulphur dioxide and a small amount of sulphur carbon compounds, such as carbon di-sulphide.

The experimental observations upon which the foregoing statements are based follow with the chemical reactions which seem to most nearly explain them.

Preliminary experiments.—The first experiment was performed for the purpose of determining approximately to what degree hydrogen sulphide and sulphur dioxide united at various temperatures to give sulphur and water.

Hydrogen sulphide was generated by the action of hydrochloric acid on ferrous sulphide in a flask having three stopcocks; one leading to the atmosphere; one for the admission of acid and one in the tube passing into the combustion chamber, the latter being the only outlet open while the experiment was running. This gas was passed up through a large bottle containing wet, broken brick to remove any free sulphur which might be present.

Sulphur dioxide was generated in a similar flask by the action of hot, concentrated sulphuric acid upon metallic copper.

Both gases were dried through calcium chloride tubes, since water was looked for as an end product, and then led through a porcelain tube, referred to as the combustion chamber, one inch in diameter, which was heated by a series of bunsen burners. This combustion chamber was cemented with plaster of paris to a water jacketed condensing tube, through which the gases passed into the atmosphere after the possible precipitation of their content had been accomplished.

The results obtained were all that could be desired. Precipitation of sulphur and water started while the gases were at a comparatively low temperature, approximately 300 deg. C., and increased in amount until at a dull red heat, water was dripping from the end of the condenser, and a thick shell of elastic, amorphous sulphur had formed within. At this point during the first trial the amount of sulphur dioxide escaping had been very considerably reduced and the hydrogen sulphide had been practically eliminated, only a very faint trace being obtainable with lead acetate. It was evident, however, throughout this experiment, that an excess of sulphur dioxide was being generated. But a later run reversed these conditions and the sulphur dioxide was so reduced that the gases could be inhaled with no serious discomfort. Methyl orange, however, in a faintly alkaline solution, gradually changed color when subjected to the gases, indicating the presence of some small percentage of sulphur dioxide.

The equation representing the reaction occurring in this experiment is:

$$2H_2S + SO_2 = 2H_2O + 3S.$$

This experiment indicates that it is possible to reduce sulphur dioxide to free sulphur with hydrogen sulphide, and the method of supplying this reagent was the next point investigated.

Various possibilities present themselves. For example, assuming crude oil to be used as fuel, we have present a variety of hydrocarbons of which methane, CH_4, may be taken as a type, and a very probable reaction is indicated as follows:

$$SO_2 + CH_4 = H_2S + H_2O + CO.$$

The reduction of sulphur dioxide by means of hydrocarbon gases has been accomplished by other investigators, among whom might be mentioned Dr. Gottlieb of the United States Bureau of Mines.

*From the California Derrick, July 10, 1915.

Another possibility is that the methane and metallic sulphide in the presence of only enough oxygen to burn the carbon in the methane, may give results directly, as for example::

$$2FeS_2 + CH_4 + O = 2FeS + 2H_2S + CO.$$

But the reaction most desired was the formation of hydrogen sulphide by the action of steam upon the pyrite and this was the point investigated in the next series of experiments.

A combustion chamber similar to that described above, about one-half filled with crushed pyrite was connected as before to the condenser, and steam under three pounds pressure was led in through an eight-inch pipe.

The temperature was raised to an incipient red and held there for half an hour. A very notable volume of hydrogen sulphide was given off and some sulphur was precipitated, but no sulphur dioxide could be detected. These results apparently contradict those obtained by the Bureau of Mines in somewhat similar experiments, for here it is claimed sulphur dioxide was an end product. Differences in temperature and amount of steam used may account for the discrepancy noted. Upon examination of the remaining mineral it was evident that most of it which had been exposed to direct contact with the steam had been changed to the hydrous oxide of iron, $2Fe_2O_3.3H_2O$, indicated by a yellow stain. The remainder was left untouched or as a black sulphide, probably FeS.

A second run on pyrite at a dull red heat gave a much larger volume of hydrogen sulphide and considerably more sulphur, due no doubt to the distillation of the first atom. Very satisfactory results were obtained with commercial ferrous sulphide, FeS, although a simple equation, denoting the reaction, shows a consumption of heat on comparing the heats of formation, thus:

$$FeS + H_2O = H_2S + FeO$$
$$24{,}000 + 58{,}060 \quad 4{,}800 + 65{,}700$$
$$82{,}060 \quad 70{,}500$$

An equation showing the reaction with pyrite from which the iron sulphur has been distilled might be as follows:

$$2S + 2FeS + 3H_2O = Fe_2O_3 + 3H_2S + S.$$

This also is a heat consuming reaction, but, because of the large excess of steam used the rapid removal of hydrogen sulphide and the plentiful supply of heat, the reaction went forward at a rapid rate.

All the possibilities considered and the results obtained from the foregoing experiments indicated that an experimental furnace was a necessity for further study. To obviate the necessity for two compartments, it was decided to build only one and to use it intermittently for roasting and smelting.

The furnace shell consisted of a six foot section of 36 in. water pipe and this was cut for flue, tuyeres, tap-notch and pyrometer pipes and lined with seven inches of fire brick, which left a twenty-two inch opening for the ore.

The vacuum chamber was designed to draw 1,000 cu. ft. of air through the furnace per minute and to create this draft a 6 inch Byron Jackson centrifugal pump, rated at 1,125 gallons per minute, was directly connected to a 30 h.p. Wagner motor. This pump required, theoretically, only 19 h.p., but to allow for all possible contingencies, 30 h.p. was considered to be sufficient.

The flue from the furnace to the vacuum chamber was of 6 inch pipe, in which a gate valve was placed to control the amount of air passing through the charge. This was water-cooled by a sprinkler above, and the waste water was carried through the vacuum chamber to the tank. Below the gate a vacuum gauge was placed. This registered from zero centimeters, when the gate was open and no ore was in the furnace, to 76 centimeters, when the gate was closed.

The water tank was cylindrical and fitted with a partition between the openings to and from the pump. This partition came to within 2 inches of the water surface and served to prevent the return of water carrying gas bubbles to the pumps. A cover, tightly caulked, was put on the tank and bored to admit a 6 inch flue leading out of the building. Gas samples were taken from the top of the tank through small holes.

Furnace adjustments.—Preliminary runs were made as soon as the plant was complete, to determine the grade and amount of oil required, volume of steam to be admitted, temperature most desired and the possible range of temperatures.

These runs showed that a light grade of fuel oil was necessary because of the small burners used and about 15 gallons was consumed per hour. Two three-quarter inch pipes carrying steam under 4 lb. pressure gave very good results, but it was found necessary to keep the ore about 2 feet above the tuyeres and to use only one burner to keep the temperature below the melting point of the ore. The ore was held up by filling the furnace to this level with crushed limestone or magnesite. Between 900 and 950 degrees centigrade proved to be the most desirable temperature, and this was maintained during the latter part of our later runs.

Method of obtaining data.—It is obvious that if the results were to be of value, fairly accurate observations were essential and the nature of these is as follows:

The per cent. of sulphur in the ore was known and an analysis for sulphur was run on several samples taken after the run. The gas escaping from the tank was frequently sampled and tested for sulphur dioxide by measuring the amount of gas required to discolor an iodine solution of known strength. This is the usual method and is given in full in Dennis' "Gas Analysis," but is only accurate where hydrogen sulphide is lacking, for this gas will also discolor the solution.

When both these gases were allowed to pass through the solution, although the odor of hydrogen sulphide was noticeable, and the percentage of sulphur dioxide was calculated on the basis of the volume of gas passed through, this percentage was so low as to make a distinction between the two gases superfluous.

To return to the observations recorded:

During any of the runs, other notes made apply to the following; time of observations, temperature of furnace as recorded by a thermo-electric pyrometer reading to 1,300 deg. C., vacuum on the furnace nozzle [illegible] pressure steam used, etc.

The following data applies to the first trial giving good results.

April 22, 1915

Charge—250 lb. sulphide ore averaging 46 per cent. sulphur.

Air pressure—[illegible] vacuum pressure 4 lb.

Temperature readings obtained at a point 2 ft. above the bottom of the ore [illegible] above the tuyeres.

Start furnace 9.27 a.m. T equals 20 deg. C.

The temperature was below 700 deg. about a third

of the running time. The next third it was between 700 deg. and 800 deg. The highest temperature at the end of the run was 870 deg.

Total time 4 hours 23 minutes. Stops 29 minutes. Running time 3 hours 54 minutes. Oil used 60 gallons.

Gas Tests.

Time	Temperature Centigrade	Per cent Sulphur dioxide	Remarks on Hydrogen Sulphide
10.16	380	...	Trace with lead acetate
10.30	630	...	Trace with lead acetate
10.52	700	0.18	Rapid discoloration of lead acetate
11.13	695	0.12	Same
11.35	675	0.20	Same
1.45	860	0.20	Same

Sulphur in Calcines.

No. 1—Picked pieces, blackened, showing core of sulphides. Content 20.9 per cent. sulphur.

No. 2—Sample taken from close to the bottom of the ore column. Content 5.97 per cent. sulphur.

No. 3—Same as No. 2. Content 4.1 per cent. sulphur.

The furnace filler in this case was limestone and this was completely calcined, slacking violently when thrown into water.

Before the next run, the small 15 gallon oil tank was replaced by a 110 gallon drum in order to avoid the hourly stops for oil.

Tabulated observations taken during this run follow: April 24, 1915.

Charge and general starting conditions were the same as in the previous run. Started furnace at 1.30 p.m.

Time.	Temperature Centigrade	Vacuum Cm. Hg.	Water Pressure Lbs. per sq. in.
1.55	360	9	32
2.05	400	9	32
2.15	500	9	32
2.25	575	9	32
Started to add steam—gradually increased amount.			
2.35	560	9	32
2.45	600	9	32
Adjusted draft and oil to increase the temperature.			
2.55	700	25	30
3.05	850	20	30
3.15	925	30	29
Maximum steam supply on.			
3.25	965	31	29
Reduced the temperature.			
3.35	920	47	28
3.45	925	37	29
3.55	925	37	29
4.05	920	37	29
4.15	900	37	29
4.25	905	37	29
4.35	900	37	29
4.45	905	37	29
4.55	890	37	29
5.05	910	37	29
5.15	900	37	29
5.25	890	12	31
5.35	890	12	31
5.45	900	12	31
5.55	880	12	31

Total time, 4 hours 25 minutes.

No stops.

Oil used—50 gallons.

Gas Tests.

Time	Temperature Centigrade	Per cent. sulphur dioxide	Remarks on Hydrogen Sulphide
2.31	570	...	Good test
2.54	700	0.21	Strong test
3.26	965	0.12	Strong test
5.30	890	0.14	Strong test

The calcines obtained from this run, with the exceptions of a few pieces near the brick work at the top were perfect in appearance, and analysis showed the sulphur content to have been reduced to from 3.9 per cent. to 5 per cent.

During all the runs made a thick, black precipitate was caught in the water tank consisting, for the most part, of unburned carbon and metallic sulphur. When dried, this burned readily with the sulphur flame, giving off quantities of sulphur dioxide.

An analysis made on similar material brought from Herault after the experiment made there showed:

Sulphur, 61.52 per cent.; silica, 4.94 per cent.; Ferric oxide, 15.12 per cent.; copper, trace; carbon, 20.0 per cent plus or minus.

The recovery of pure sulphur from this precipitate is a simple matter and requires no comment here.

Smelting.—During the preliminary runs such evidence of high temperature obtainable in the zone of fusion were noted as to make a special smelting run on the calcines unnecessary. In these runs fire clay, sulphide ore and lime were fused rapidly and, as already stated, it was only by cutting out one burner and the use of magnesite filling that a roasting temperature could be obtained in the space available.

Commercial Possibilities of the Process Applied to Sulphide Ores.

Considering the results obtained, with the possibility of commercial success for the process in view, it is a fact that no difficulties were encountered or suggested which were not easily overcome and that the desired results were satisfactorily accomplished. Furnace conditions easy to maintain and necessary adjustments throughout the operations were few, all being simple and involving no delay. All observations made seem to justify the development of the process on a larger scale and no doubt this action will be taken in the near future.

The complete plant herein described was designated for one special type of ore, but it was obvious that the basic principle embracing the vacuum draught and the perfect washing of the flue products resulting from this feature, might well be applied to the reduction of other ores requiring either roasting or smelting alone.

THE COPPER CLIFF BAND.

Elk Lake, July 16.

The Copper Cliff Band, which is the regimental band of the 97th Regiment, has remitted to Col. H. E. McKee, $116, proceeds of a concert given by the band at Copper Cliff. This money is for buying comforts for the members of the regiment in the trenches and is being sent by the commanding officer to the front for that purpose. The Copper Cliff Band is one of the best bands in Ontario and took part in the musical programme at Toronto Exhibition last year. It is maintained by the Canadian Copper Company, and is a great acquisition to the 97th Regiment, the members being very public-spirited and enthusiastic musicians. Under the leadership of Bandmaster John Gribble, the organization has reached a high state of perfection.

McINTYRE-PORCUPINE MINES, LTD. ANNUAL REPORT

In a report issued on July 15, 1915, Col. Alex. M. Hay, recently elected president of McIntyre-Porcupine Mines, Ltd., says:

The directors spent a few days at the property in the early part of last month, and were very favorably impressed with the physical condition of the mine and the satisfactory operations being conducted at the mill.

The ore bodies, which on account of their lenticular character and owing to numerous faultings near the surface, have been very irregular in their occurrence in the levels so far worked, appear to be improving in size and values as depth is reached. It is reasonable to expect that after the faulted zone has been passed through, the ore deposits will be found to be more regular in their occurrence at greater depth.

A policy of aggressive development work will be pursued, and increased milling capacity will be installed as required, to keep pace with development of ore. No. 5 shaft has reached a depth of 500 ft. and a station cut. So soon as work has progressed to a sufficient distance from the shaft, sinking will be resumed to 600 and thereafter to 700 ft., which depth is expected to be reached before the end of the present year.

At No. 4 shaft on the 600 ft. level, ore bodies east and west of the shaft have been opened up, showing a width of from 12 to over 20 ft. of pay ore. This shaft will be sunk to the 700 ft. level after No. 5 shaft has reached that depth.

The production and profits for the last three months have been as follows:

	Tons Milled	Gross Value per ton	Recovery per ton	Recovery Total	Costs Total	Costs per ton	Net Profit
April ..	7,870	$8.32	$7.98	$62,820	$39,043	$4.96	$23,777
May ...	8,360	7.31	6.99	58,413	34,485	4.12	23,928
June ...	9,180	8.00	7.71	70,800	39,474	4.30	31,326

In view of certain statements recently circulated to the effect that the market in the shares of this company was being manipulated by insiders, I have made careful inquiries and find that neither any of the large shareholders or directors have been parties to such manipulation, if any. The directors cannot be responsible for any statements circulated without their authority. For the information of shareholders, and in their interest, official reports will be issued [illegible] time to time, setting forth the true position of the company.

Manager's report.—Mr. R. J. Ennis, manager, reports for the year ending December 31st, 1914 and for the period January 1st to March 31st, 1915 as follows:

The property of the company consists of 32.1 acres of land and 112.9 acres under Pearl and Gillies lakes, or a total of 145 acres.

Claim No.	Area	Pearl Lake	Gillies Lake
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	8.1 acres	104 acres	41.9 acres
"West McIntyre" [illegible]	[illegible]	65.6 acres	[illegible]
"Water Lot"	[illegible]	[illegible]	[illegible]

Development work to date has been confined to Claim No. 14307 upon which are located the shafts, mining plants and mill. Exploratory work on the rest of the property has been limited to a study of geological conditions, surface trenching on the West McIntyre lot and to a diamond drill hole in the water lot, put down at the narrows in Pearl lake.

Production.—During the year 62,209 tons of ore was treated.

Average value per ton	$ 9.262
Extracted per ton	8.828
Tailing loss	.434
Gross value	576,217.60
Bullion produced and by-products obtained	549,255.42
Total loss in tails	26,962.18
Extraction, 95.3 per cent.	

	Tons.
Ore mined in stopes during the year	63,786
[illegible] during the year	[illegible]
Broken ore reserves in stopes was increased	7,564
[illegible]	[illegible]
Waste hoisted during the year	20,513

From January 1st to March 31st, 1915, 23,445 tons of ore was treated.

Average value per ton	$ 7.85
Extracted per ton	7.56
Tailing loss	0.28
Gross value	184,014.56
Bullion produced and by-products obtained	177,261.24
Total loss in tails	6,753.32

Since the beginning of operations to March 31st, 1915, the property has produced $1,020,250.34 in gold bullion, the result of milling 127,349 tons of ore.

Development.—The vein systems developed on the property may be classified as follows:

Veins in the basalt and grey schist and veins in the contact between the quartz porphyry and grey schist on the south side of Pearl lake.

No. 5 vein and veins in the contact zone paralleling the north contact between the quartz porphyry and the basalt on the north side of Pearl lake.

Veins in the quartz porphyry.

The workings of No. 1 shaft are located in the quartz porphyry. As the orebodies heretofore found in this formation have been erratic, both as to their occurrence and values, very little development work has been done on them within the year. A stope was started on a body of ore encountered in 303 and 304 drifts and 1,950 tons of ore milled. It was found necessary to discontinue running this ore into the mill, as it contains a large percentage of sericite, which settles very slowly, thereby reducing the capacity of the mill.

No. 2 and No. 3 shafts were originally prospecting shafts, and the work on the orebodies which they developed is now carried on through No. 5 shaft.

No. 4 shaft.—During 1914 100 ft. of sinking was done in the shaft, from the 500 to the 600 ft. level. In January and February, 1915, it was sunk to the 700 ft. level.

[illegible] ft. level 450 ft. of drifts and crosscuts were driven and 4,218 tons of ore drawn from stopes.

500 ft. level 310 ft. of drifts and crosscuts were driven; 23,943 tons of ore were drawn from the stopes. The stopes on this level have developed [illegible] ore more than was estimated as being available at the [illegible] of April 1st, 1914.

400 ft. level. 1,663 ft. of drifts and crossents were [illegible] on this level, and 16,67[illegible] tons of ore were drawn from stopes. [illegible] drift communicates the [illegible] and it was driven on for 400 ft., showing a [illegible] 0.25 ft., and assaying $11.81 [illegible]. The quartz porphyry vein opened up in 303 and 304 drifts was cut on this level, showing a width of 11 ft. and assaying $6.00.

500 ft. level.—1,119 ft. of drifts and crosscuts were driven and 3,581 tons of ore drawn from stopes. Three new orebodies were opened up in the basalt on this level. The first in blocks I and J, 90 ft. long, assaying $11.50 over 4.5 ft., the second in blocks L and M, 60 ft. long, assaying $10.98 over 4.3 ft., the third in block M, 70 ft. long, assaying $4.66 over 4.4 ft. The contact vein was opened up in 517 drift for a distance of 240 ft.

600 ft. level.—500 ft. of drifts and crosscuts were driven. The west face of 611 drift at present shows 4.5 ft. of $4.00 ore, and the east face of 610 drift shows 20 ft. of $7.90 ore. The contact between the quartz porphyry and the basalt was cut 63 ft. north of the shaft, without any ore being found. 610 and 611 drifts will be continued east and west, and the contact to the north prospected with the diamond drill.

bodies of ore in the contact zone, and showing slightly higher value than on the 200 ft. level.

400 ft. level.—The shaft was completed to this level, and the station cut December 30th, 1914. From Jan. 1st to March 31st, 1915, 500 ft. of drifts and crosscuts were driven. From a study of No. 5 fault on the 300 ft. level, it had been determined that the No. 5 vein would be found south of the shaft. This was later proved by diamond drilling, when it was found that the fault had a throw of 130 ft. The vein was found with little trouble, and has now been drifted on for 170 ft., averaging 11.2 ft. in width and in value $8.43 per ton; at the widest part the vein is 43 ft. No stoping has been done from this level. A crosscut in block "C" driven south into the contact zone, cut 4.6 ft. of ore, averaging $8.23.

500 ft. horizon.—Diamond drill hole No. 47, put

Hardinge and Tube Mills, McIntyre Plant, Timmins, Ont.

No. 5 Shaft.

200 ft. level.—555 ft. of drifts and crosscuts were driven and 6,506 tons of ore drawn from stopes. Early in the year a diamond drill hole located the west extension of 215 vein; it proved to be a shoot of ore 125 ft. long, of good grade and extended up to fault No. 41.

214 drift was advanced to the east on No. 5 vein fissure, which contained only 1 inch of quartz. 100 ft. east of the shaft 214D raise was started on this quartz stringer, and at 40 ft. above the drift 3 ft. of ore was found; this ore is being stoped. 214E raise has, since January 1st, 1915, encountered the same ore body at 60 ft. above the 214 drift, and it is expected that the 215 vein will have a large easterly extension above this point. A crosscut from 214 drift in block F cut 4.2 ft. of $3.00 ore in the "North Contact Zone."

300 ft. level.—550 ft. of drifting and crosscutting was done on this level within the year, and 9,539 tons of ore drawn from stopes. Stoping operations in 314 and 315 stopes in the first part of the year were costly on account of the presence of faults No. 1 and No. 5. 314 drift was advanced to the east, locating several

down at 35° from 412 drift on the 400 ft. level, cut No. 5 vein 12 ft. wide at 500 ft. below the collar of the shaft, and 20 ft. south from this vein penetrated 7 ft. of $12.80 ore in the contact between the quartz porphyry and basalt.

A crosscut from the east end of Pearl lake workings was driven 248 ft. into the McIntyre property in block H. No ore was found. On the 600 ft. level the crosscut from the Pearl Lake was continued to a point 550 ft. into McIntyre ground, this work was started for the purpose of connecting with No. 4 shaft, and to explore the ground under Pearl Lake. The last 100 ft. of this drive was in soft, swelling porphyry, and was difficult to hold with timbers. As the crosscut advanced towards the middle of Pearl lake the quantity of water increased, and as it flowed from the face with some pressure, it was decided to discontinue the work. Concrete bulkhead was placed in the crosscut, and after being sealed for two weeks, the water behind it had reached a pressure of 200 lb. per square inch.

Exploration.

In 1913 it was recognized that the location of the orebodies on the south side of Pearl Lake was con-

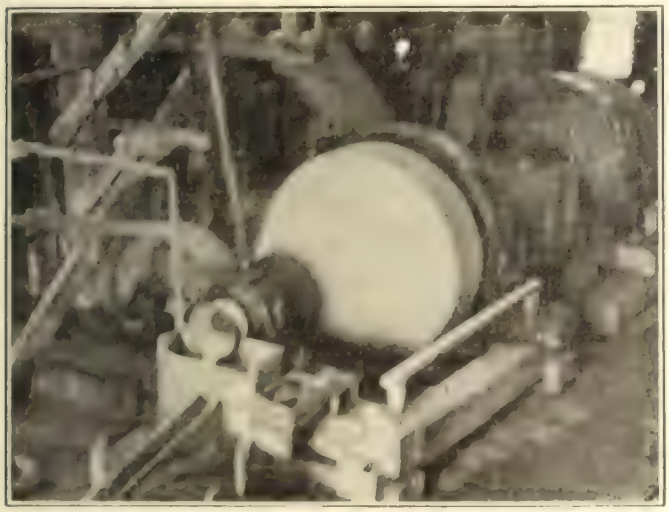
trolled by structural conditions, and that a close study of these conditions was necessary to carry on development work intelligently. A geological department was created at the beginning of the year to do this work and to assist in solving the serious faulting problems at No. 5 shaft. The work of the department has been successful, and it has placed in the possession of the company data and deductions that will be valuable for the future development of the property.

3,306.6 ft. of diamond drilling was done in connection with the geological work.

Ore Reserves.

Experience in developing and stoping the orebodies on the property has demonstrated that their form and occurrence render it impracticable to attempt to block out ore in the usual manner, therefore, the form and extent of the orebodies have been estimated from geological evidences supported by mining operations.

	Tons.	Value.	Per ton.
Estimated ore reserves, as of March 31st, 1915.	93,836	$741,218	7.89
Broken ore in stopes, as of March 31st, 1915	15,857	113,218	7.14
	109,693	$854,436	



Hardinge Mill, McIntyre Plant

Milling.

The ores of the property are remarkable in that they yield a larger per cent. of their gold content to the simple treatment of grinding them in cyanide solution, and giving them a short period of agitation. Our efforts have been to take full advantage of this fact and make the plant as simple as possible. In June work was started on a second unit of 150 tons capacity. This was completed in September at a cost of $55,000. The same process of treatment was used in the new unit as had been in operation in the old unit for 18 months, except that continuous counter decantation was installed instead of filters. The continuous counter decantation process proved entirely satisfactory, reducing the cost of treatment 14 cents per ton. In January, 1915, the filters in the old unit were discarded and the counter decantation system installed.

Conclusions.

During the year good progress has been made in solving the problems met in the operation of the property in the years 1912 and 1913.

Mine development has been satisfactory and continues to show steady improvement. Development work on the 500 and 600 ft. levels of No. 4 shaft proves these levels to be as productive as the upper levels. Lateral development on the upper levels continues to encounter new ore bodies.

The average width of No. 5 vein has increased from 6.5 ft. on the 300 ft. level to 12.5 ft. on the 400 ft. level with no change in values. This vein has been cut by diamond drill on the 500 ft. horizon, and is 12 ft. wide.

Three bodies of ore have been encountered by diamond drill in the north contact below the 300 ft. level. The north contact offers strong possibilities for payable ore bodies, and development work is now being done in this direction.

Underground and surface conditions are favorable for a steady improvement during 1915.

Operating Costs, McIntyre Mine, for Year Ending Dec. 31, 1914.

		Per ton of Ore Milled
General charges	$54,182.15	$87.10
Mining	142,627.50	2.29.27
Mine development	98,663.55	1.58.60
Exploration	2,597.02	04.17
Milling	76,706.08	1.23.30
Maintenance, plant and buildings	4,992.65	1.23.30
Bullion selling cost	3,535.69	05.68
[illegible]	[illegible]	[illegible]
	$398,506.86	$6.40.59

Operating Costs for January, February, March, 1915.

		Per ton of Ore Milled
General charges	$12,959.20	$55.28
Mining	51,380.26	2.19.15
Mine development	23,136.17	98.68
Exploration	798.36	03.40
Milling	24,648.07	1.05.12
Maintenance, plant and buildings	1,026.54	04.38
Bullion [illegible]	[illegible]	[illegible]
Interest and exchange	2,614.75	11.16
	$117,772.99	$5.02.33

Operating cost for the first quarter, 1915, showed a material reduction over the cost for 1914; this is due to the increased tonnage handled in the mill. Improvements under way will tend to further decrease mine costs. Costs shown include all charges except depreciation of plant.

Milling Record, McIntyre-Porcupine Mines, for Year 1914, and from January 1st to March 31st, 1915.

Month, 1914	Tons Milled	Average Value	Gross Value	Bullion Exchange and [illegible]	[illegible]
January	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
February	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
March	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
April	4,215	11.70	49,315.50	46,210.67	
May	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
June	1,390	10.65	16,753.50	13,129.27	
July	4,850	10.35	50,197.50	47,705.78	
August	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
September	5,530	8.25	45,622.50	42,599.01	
October	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
November	7,670	7.59	58,221.00	55,656.15	
December	8,134	6.61	54,037.55	52,762.74	
Total 1914	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
January	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
February	7,090	8.27	58,634.30	56,048.44	
March	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Expenditure for Building Plant and Equipment, from January 1st, 1914, to March 31st, 1915.

Buildings and Equipment.		
Bunkhouse and equipment	$2,640.45	
Dry House at No. 4 shaft	1,520.26	
Dwelling Houses	1,532.61	
Oil house and equipment	1,148.64	
Miscellaneous	775.75	
		$7,617.71
Plant and Equipment.		
Cyanide mill (buildings and equipment)	$64,417.14	
No. 1 power house and equipment	94.12	
No. 4 power house and equipment	861.41	
No. 5 power house and equipment	467.20	
No. 4 shaft house	162.48	
Refinery (building and equipment)	1,000.90	
Assay office (building and equipment)	301.10	
Aerial tram	193.24	
Compressor and air equipment	1,305.42	
Mine equipment	16,725.37	
Pump house and water lines	182.99	
Machine shop equipment	1,356.82	
Blacksmith shop and drill sharpener equipment	2,497.22	
Electrical equipment	727.03	
Tramways	1,073.72	
Tools and steel	1,610.64	
Fire equipment	1,270.56	
Mill storehouse	396.94	
Surveying instruments	355.20	
Heating equipment	279.54	
Telephone equipment	277.13	
Miscellaneous	174.63	
		$95,730.80

Balance Sheet, McIntyre-Porcupine Mines, Ltd., March 31st, 1915.

Assets.

Capital Expenditure—			
Mining properties			$2,404,378.70
Plant—brought forward from 1913	$324,956.49		
Less adjustments	1,402,75		
	$323,553.74		
Additions since 1st Jan., 1914	103,348.51		
	$426,902.25		
Less depreciation for 1914	32,245.67		
			394,656.58
Development brought forward from 1913	$209,812.28		
Less adjustments	304.52		
			209,507.76
			$3,008,543.04
Current Assets—			
Cash in bank and on hand	$1,842.50		
Accounts receivable	1,989.76		
Guarantee deposits	368.27		
Stores	44,472.63		
Charges paid in advance	7,317.53		
Bullion assets, etc.			
Bullion shipped and not paid for	$44,831.61		
Gold in slag—estimated and matte	1,959.55		
	46,791.16		
			102,781.85
Deferred Development charges			1,888.40
Discount on shares sold			205,492.50
Discounts on Bonds sold			9,000.00
			$3,327,705.79
Liabilities.			
Capital Stock—Authorized	$3,000,000.00		
Less in Treasury	13,015.00		
			$2,986,985.00
Current Liabilities—			
Accounts payable	$37,704.53		
Bills payable, bank advances	$57,000.00		
Trade	507.51	57,507.51	
Wages		18,942.48	
Unclaimed cheques		550.05	
			114,704.57
First mortgage 7% gold bonds	250,000.00		
Less unsold	$107,000		
Less repurchased	88,500	195,500.00	
			54,500.00
Reserves—			
For interest accrued on bonds	438.98		
Government tax, due Oct., 1914	500.00		
Government tax, due Oct., 1915	3,450.00		
For bad and doubtful debts	600.00		
			4,988.98
Surplus—			
Premium on shares sold re-invested in plant	9,747.00		
Less written off plant (part only)	9,747.00		
Profit and Loss account—			
Debit balance from 1913	35,661.35		
Add adjustments, 1913	7,464.62		
	$43,125.97		
Credit profits Jan. 1st, 1914, to March 31st, 1915	232,751.88		
	$189,625.91		
Less reserve for bad and doubtful accounts	600.00		
Less depreciation (bal.)	22,498.67		
	23,098.67		
			166,527.24
			$3,327,705.79

Operating Account, McIntyre-Porcupine Mines, for Period from Jan. 1st, 1914, to March 31st, 1915.

To General charges	67,141.35	
Mining	194,007.76	
Mine development	121,799.72	
Exploration	3,395.38	
Milling	101,854.15	
Maintenance, plant and buildings	6,019.19	
Bullion selling cost	4,745.33	
Interest and exchange	17,816.97	
Adjustment, 1914	201.87	
By bullion production		$718,331.71
Rentals		1,801.39
Cash discounts		72.96
Miscellaneous revenue		977.43
Discounts on bonds purchased		28,050.00
To Transfer to Profit and Loss	232,751.88	
	$749,233.60	$749,233.60

CANADIAN ZINC.

Ottawa, July 15.

Steps are likely to be taken to encourage zinc refining in this country, and the members of the Cabinet yesterday conferred with the Shell Committee in regard to the supply of zinc for the manufacture of Canadian shells. It was announced by General Hughes some time ago that this matter would shortly demand Government consideration.

Canada produces large quantities of zinc ores, but the refining is mostly done in United States plants. With the demand created by the manufacture of shells, the price of zinc rose rapidly. Canada will now need more and more of this metal as she engages more largely in the making of munitions.

The Government of British Columbia a few weeks ago appointed Judge Forin, of Nelson, a commissioner to inquire into the responsibility of mine officials in connection with an explosion that occurred at one of the mines of the Coal Creek colliery last January, when a mine inspector lost his life.

Chile Copper Company has made its first commercial copper and has shipped it direct to Europe. Daily shipments of ore to the mill are running about 4,000 tons against 10,000 tons, the capacity of the first unit.

PERSONAL AND GENERAL

Mr. Chas. A. Banks, general manager for the Jewel-Denero Mines, Ltd., left Greenwood, Boundary district of British Columbia, about the middle of July on an eastern trip.

Mr. Chas. F. Caldwell, of Kaslo, B.C., manager of the Utica silver-lead mine in Ainsworth mining division, is on a visit to Chicago and other places.

Captain Bruce, of Haileybury, serving with a British regiment at the Dardanelles, has been wounded, and is in London, to recuperate.

Mr. Oliver Cotter, Kingston, with the Queens Engineers, was wounded at La Basse.

Mr. John Gibbens, of the Calumet and Hecla staff, was married on July 17 to Miss Nellie Peterson, of Milwaukee, Wis.

The management of the Bayonne Casting Co. has been completely reorganized. Mr. J. F. McNamara succeeds Mr. W. E. Oakley as general manager.

The National Exposition of Chemical Industries will be held at the New Grand Central Palace, New York, during the week of September 20, 1915.

Dr. W. G. Miller and Mr. C. W. Knight are examining a pre-Cambrian area north of Lake Huron.

Mr. J. K. Cram, formerly in charge of operations at the Consolidated Mining and Smelting Co.'s Highland mine, near Ainsworth, B.C., is now superintendent at the company's Sullivan group lead mine in East Kootenay, succeeding Mr. C. H. McDougall, who has been transferred to Trail, where the company is making important additions to its smelting works.

Mr. Graham Cruickshank, of Rossland, B.C., has volunteered for active military service, and has joined the forces in training at Vernon, Okanagan district, in that Province.

Dr. Charles W. Drysdale, of the Geological Survey of Canada, recently proceeded from his camp in Lillooet district to Rossland, B.C., where he read a paper at the twentieth meeting of the Western Branch of the Canadian Mining Institute, held on July 15.

Mr. F. M. Handy, professor of metallurgy at the State College of Washington, Pullman, State of Washington, was in Nelson mining division of British Columbia, last month, conferring with Mr. Francis A. Thomson, head of the mining engineering department of the same college, relative to mining and ore-treatment problems at a gold property south of Nelson.

Mr. Robert R. Hedley, of Vancouver, B.C., is now at the Bluebell mine, Kootenay lake, West Kootenay.

Mr. G. P. Jones, general superintendent for the Hedley Gold Mining Company, which is operating the Nickel Plate group of mines, situated in Camp Hedley, Similkameen, B.C., was in Victoria early in July.

Mr. J. P. Keane, of Sandon, B.C., who with associates is operating the Ivanhoe concentrator as a custom plant and is there concentrating lead-zinc ores from Slocan mines, has returned to Sandon from a business visit to Spokane, Wash.

Mr. Harold Lakes, of Ainsworth, B.C., superintendent of the Silver Hoard mine, is about to take a trip to Southern California.

Mr. Andrew G. Larson, of Spokane, Wash., was in the Slocan district of British Columbia recently in connection with the resumption of mining work at the Lucky Jim mine which is now being operated under his supervision.

Mr. N. E. Linsley, of Spokane, Wash., was at Ainsworth in July, examining mining property for Spokane owners.

Sir Richard McBride, Premier and Minister of Mines for British Columbia, has returned to Victoria after having been absent three months at Ottawa, New York City and in Europe.

Mr. J. W. D. Moodie, of Britannia Beach, B.C., vice-president and general manager of the Britannia Mining and Smelting Company, Limited, was in New York City last month conferring with his principals relative to important work in progress at the company's copper mine and concentrating plant in Vancouver mining division of British Columbia.

Mr. Harry W. Newton, who some years ago was on the staff of the Northport Smelting and Refining Company, which then treated the ore output of the Le Roi mine, Rossland, B.C., is now at a mine at Nighthawk, Washington.

Mr. Stuart J. Schofield, of the Geological Survey of Canada, now has his field camp on Woodberry creek, in Ainsworth mining division, British Columbia, where he was recently visited by Mr. W. L. Uglow, of Kingston, Ontario.

Mr. Robert H. Stewart, general manager for the Consolidated Mining and Smelting Company of Canada, Limited, left Trail on July 13 on a business trip to Eastern Canada.

Mr. J. S. Wallace, years ago office manager for the Le Roi Mining Company at Rossland, B.C., but since then, with Messrs. F. W. Bradley and J. H. Mackenzie at San Francisco, California, spent several days of last month renewing old acquaintanceships at Rossland. He is now connected with mining operations in Juneau district, Alaska.

M. Beatty & Sons, Limited, announce that the control and management of the company has been changed. Mr. H. L. Beatty has been elected president, and Mr. A. O. Beatty vice-president and general manager. Mr. Harris T. Dunbar, of Buffalo, has been elected member of the board of directors. Messrs. V. R. Browning and B. F. Miles, directors, and R. A. Greene, general manager, who have had charge of the business for the past three years, have severed their connection with the company.

Captain Hart Martin, of the Coniagas mine, Cobalt, was presented with a giant leaf of silver, suitably engraved, on the 10th anniversary of the beginning of mining operations at the Coniagas. The presentation was made on July 15 by Major Leonard, president of the company.

Mr. L. B. Ames has been appointed mill superintendent at the Hollinger mine, Timmins, Ontario.

Mr. Julio Madero, mining engineer, brother of the late President Madero of Mexico, was married in Los Angeles on July 16 to Miss Carmen Garcia.

William T. Dunn, formerly tool steel expert for the Carpenter Steel Company, in Boston and New England, has been appointed by the International High Speed Steel Company, of New York, district sales agent for New England and Eastern Canada. Mr. Dunn is at present taking a trip through the Cobalt and Porcupine mining district.

Lieut.-Col. Cantley has been elected president of the Nova Scotia Steel and Coal Company.

Mr. A. R. Globe, of the Hollinger staff, was in Houghton, Mich., last week visiting the copper mines.

Mr. T. C. Trethewey, for some years on the staff of the Kerr Lake Mining Company, has enlisted in the British army as a sapper.

SPECIAL CORRESPONDENCE

COBALT AND SOUTH LORRAIN

Dividends.—According to figures which have just been published, it appears that the total dividends paid by Cobalt and Porcupine mines to the end of June, 1915, amounted to a grand total of $63,799,440.75; of this the two principal camps have contributed as follows:

Cobalt	$60,157,440.75
Porcupine	3,642,000.00

During the last two weeks the price of silver has not shown any gain whatever, and in consequence there is a general disposition to store bullion even if dividends have to be cut. Coniagas has set the fashion by cutting its dividend from six to three per cent. The Coniagas is almost a close corporation and therefore can cut dividends without much affecting the public. Other companies with a larger list of shareholders may hesitate to take this drastic step; but if the price of silver continues as low as it is they may be forced to adopt similar action.

Slag Cars, Canadian Copper Co., Copper Cliff, Ont.

That there is no general pessimisim as to the future of the camp is well illustrated by the interest taken in any old prospects that are available. The Trethewey Cobalt is negotiating a working option with the Rochester, and will no doubt carry the deal through.

Right of Way.—Good success is attending the efforts of the lessees of the Silver Queen and the Right of Way. At both of these properties, which have been abandoned as worked out by several different managers, a good tonnage of high grade and milling ore is now being mined. It is not anticipated that this good fortune will attend them for any length of time, but it is significant that after such thorough exploration as the mines were supposed to have been subjected to, these new orebodies could be found.

Shamrock.—A circular has just been issued by a New York brokerage house, which would lead to the belief that the Shamrock will very shortly be reopened. It is the intention to sell the 400,000 shares still remaining in the treasury at 25 cents a share to provide for further development.

Beaver and Temiskaming.—The situation in southeastern Coleman in regard to the Beaver and Temiskaming has been cleared up as far as power is concerned. The Power Company and Mr. F. L. Culver have arrived at an agreement whereby the company will give the Beaver and the Temiskaming power at the old rates for some time to come, at any rate. In a circular to shareholders of the Beaver, Mr. Culver makes this point clear; he also states that it has been definitely decided to sink the shaft on the Beaver through the diabase sill to the lower contact. The main shaft is already down to a depth of 1,000 ft., and it is believed that there will be at least another 600 ft. before the lower contact is reached. The statement shows that there is bullion in storage in New York to the amount of $259,480; ore in transit to the smelters $65,899; ore bagged at the mine $41,221, making a total of $366,601. There is cash on hand to the amount of $79,864.

Coniagas.—A very interesting celebration was held at the Coniagas mine on the 15th of this month. The occasion of the celebration was the completion of a decade of mining at the Coniagas. Just ten years previously Capt. Hart Martin had stuck the first pick into the famous Coniagas vein. It will be remembered that the Coniagas was prevented from working for about two years owing to litigation. Mr. Martin, who is now mine captain, has remained with the company ever since. On the 15th Major Leonard, president of the company, made a special trip to the north in order to give Captain Martin a souvenir in the shape of a giant leaf of silver. A small portion of the silver had been polished, and upon it was engraved the dates on which Captain Martin became shift boss and mine captain.

PORCUPINE AND KIRKLAND LAKE

The Dome.—The bottom levels of the Dome mine are exciting very general attention. No public statement has yet been made as to the excellent grade and width of the orebody which has been developed from the No. 2 shaft. It is known that a crosscut has been run 400 ft. in ore and that the grade will be very much higher than in the pit. A shaft is now down to the 700 ft. level and a station is just being cut. A big crusher is now on the ground and will be installed before the end of the month. All primary crushing will be done underground, and the transportation of the ore will be

greatly simplified. The higher grade of ore in the new orebody has not yet been reflected in mill returns, because only a small proportion of it is going to the mill. As a matter of fact only 200 tons per day is coming from development of the richer orebody and 600 tons is being taken from the pit. In spite of that fact, June was a record month for the Dome in every respect except grade. The tonnage was 27,200 tons, which is more than 1,000 more than any previous month. The bullion produced was $120,821, a few thousand dollars more than the previous record in January, 1914, and the grade was higher than it has been since the beginning of the present year. In this month at least 800 tons will be treated. Within this year the management confidently expects to treat 30,000 tons a month. When this record is reached plans will probably be drawn for an enlarged mill.

Vipond.—The sinking of the winze at the Vipond mine has been attended with very good results. At 30 ft. in the winze below the 300 ft. level the vein dipped out, but it reappeared at 90 ft., and has remained in the winze to 30 ft. below the 400 ft. level. The ore is by far the richest that has been mined in the Vipond. It is 6 ft. wide. The half yearly statement of the Vipond, which will shortly be published, is very satisfactory. It shows a net profit of $53,000. The mill heads run over $10 to the ton, while costs were down to $5.86 on a relatively small tonnage. Tonnage is now about 3,400 a month. Extraction has been raised to about 95 per cent. and costs are slightly less than $5.00 a ton.

Hollinger.—The Hollinger monthly statement shows reduction in grade. This is entirely owing to the new policy at the Hollinger of mining and sending to the mill all ore that can be treated at an operating profit. Costs now average about $3.50 a ton. Fourteen or 15 veins are now contributing to the Hollinger tonnage, and there are as many more that will yield profitable ore as the ground is crosscut. This, of course, runs down the grade. The new policy looks to a largely increased tonnage at the Hollinger, and there is no doubt that in the future the mill will have to be enlarged, though this improvement may not take place this year. The directorate has obtained the services of Mr. L. B. Ames as superintendent. He comes direct from the Goldfields Consolidated mill, of which he was in charge, to Porcupine. His record at Goldfields Consolidated is a most favorable one, and the directorate believe themselves fortunate in securing his services. Owing to the large increase in the extent of operations the Canadian Mining and Finance is building a new office for the Hollinger and its allied interests.

Porcupine Crown.—At the Porcupine Crown about 60 tons of tailings are being hauled into the mill and treated. These tailings run $3.15 a ton, and an operating profit of $2.45 can be made. As a consequence only 100 tons is required from the mine itself. It is anticipated that it will not be possible to treat the 12,000 tons of tailings before the ground becomes softened with frost, but most of the tailings will undoubtedly be treated this year. The ore at the bottom of the winze at the 600 ft. level is now looking much better than at any part of the winze previously.

Teck-Hughes.—The Buffalo Mining Company is sampling the Teck-Hughes gold mine at Kirkland Lake. The shaft has been dewatered and a thorough resampling is being made by the Cobalt Company. It is expected that if the deal is made it will be on the basis of actual control of the property.

Sesekinika.—As a result of exploration of the surface of Smith LaBine claims at Sesekinika, some 14 or 15 veins have been uncovered. These veins are narrow, but quite rich, and they have lent much more interest to the district as a consequence. Near Wolf lake some veins of zinc-lead ore are attracting attention. These veins appear to contain a fair width of high grade zinc and lead ore and they are now being sampled by Cobalt houses with a view to discovering if they are worth working.

BRITISH COLUMBIA

While complete statistics of mineral production in British Columbia during the first half of the year are not yet available, there is good reason to believe that a better showing has been made than earlier in the year seemed probable.

Cariboo and Atlin.—Late reports from Cariboo encourage confidence that the gravel-washing season in that district will be longer than was expected when the season's operations were commenced, for frequent showers of rain that fell in June and July have added appreciably to the water supply stored for hydraulicking. So far as known but little hot weather has yet been experienced in placer mining districts, the season having been unusually rainy instead, so that the light snowfall of last winter will not be found to prove such a serious drawback as had been feared it would do. It is thought that in the Atlin gold field the experience of the last two months has been similar to that above mentioned as that of Cariboo field, in which case there, too, the gravel-washing season will be prolonged proportionately.

East Kootenay.

A decidedly satisfactory increase in the weekly average quantity of ore produced at the Sullivan group lead mines for 28 weeks to July 15, inclusive, is shown by the figures representing the quantity of ore received at Trail from those mines. For that period of 1915 the total was 23,836 tons, an average of 851 tons a week, against 11,964 tons, or 427 tons a week for the corresponding period of 1914. Lately the work of driving a long crosscut adit, to provide a more convenient outlet from the mines, was commenced.

Ainsworth.—The expected considerable increase in work in this district has not yet been realized. On the mines near the town of Ainsworth only the No. 1 is being worked on as large a scale as before the war. A few men are employed on the Highland, but the Banker-Maestro group is still idle, and the Silver Hoard has not yet resumed regular shipment of ore. The small mine, known as the Early Bird, situated near the head of Kootenay lake, has not shipped ore for two months. It is reported the Bluebell across the lake from Ainsworth will soon be regularly producing. The Florence Mining Co., of Spokane, Washington, is stated to have opened a considerable quantity of ore of milling grade on its Hope group on Process creek. The Gallagher, a promising property situated several miles from the town of Ainsworth, on which the owner, Mr. A. D. Wheeler, has done a deal of work, and which in past years has been a profitable shipper, is now being further developed under option of purchase by Spokane men. The Silver Hoard owns the town reservoir and several lots of ore at Trail. Some work is being done on properties on Woodbury creek. West of Kaslo there are [illegible]

mines on which operations have been resumed now that weather conditions are not unfavorable; of these the Cork-Province, Utica and Panama have sent out ore since the melting of the snow admitted of its being hauled or packed to the K. and S. Railway. Development work on the Whitewater group, owned by J. L. Retallack & Co., is affording employment to a number of men.

Slocan.—The Rambler-Cariboo, Slocan Star, Ruth-Hope group and Surprise, are all now on the producing list. Other mines around Sandon are being worked, but are not at present shipping ore. Of mines near Slocan lake, the Standard and the Hewitt-Lorna Doone group of the Silverton Mines, Ltd., are the chief ore producers at present, the Standard having in July resumed shipments of silver-lead ore to Trail after a suspension of production lasting about 11 months. The Lucky Thought, on Four-mile creek, and the Wake-field, high up the mountain opposite the Hewitt and Van-Roi mines, is again receiving attention after having been idle several years. In Slocan City division, the Enterprise sends out an occasional car of ore, and the Ottawa once more has men at work on it.

Nelson.—The Fern gold mine, situated a few miles south of the town of Nelson, has again been bonded, as, too, has the Eureka copper mine, near Forty-mile creek. A few men are doing unimportant work on the Silver King, but no ore is being shipped now. The Venus and one or two other gold properties near the town are on the active list, but their operations are not large. In the southern part of the division, properties about Salmo, Sheep creek and Erie are adding to the sum total of production, several of these producing gold, while others ship lead ore.

Ore receipts at Trail.—The following table shows totals of ore receipts at the Consolidated Mining and Smelting Co.'s smeltery at Trail for the first half of 1915, also the figures for the corresponding period of 1914:

	Six months, 1915, tons	Six months, 1914, tons
From Mines of East Kootenay	21,675	10,766
West Kootenay—		
Ainsworth Division	2,924	10,167
Slocan Division	2,385	10,875
Nelson Division	1,831	14,076
Trail Creek (Rossland)	172,856	127,925
Lardeau	56	30
Boundary	428	160
Kamloops	236	...
Coast district	101	806
Total British Columbia	202,492	174,805
Alberta	10	...
State Washington, U.S.A.	15,125	8,667
Total of ore receipts	217,627	183,472

Lake Louise and Victoria Glacier, B.C.

There were decreases in receipts of ore from Ainsworth (7,243 tons), Slocan (8,490 tons), Nelson (12,245 tons), and Coast mines (705 tons), total 28,685 tons. Against these were the following increases: East Kootenay (10,909 tons), Rossland (44,031 tons), Lardeau (26 tons), Boundary (268 tons), Kamloops (236 tons), Alberta (10 tons), and State of Washington (6,458 tons), total 62,838 tons. The net increase for the six months' period was therefore 34,155 tons. The proportion of ore from the Consolidated Company's own mines was 188,116 tons in the 1915 period, as compared with 145,362 tons in that of 1914. Custom ores totaled 29,511 tons this year against 38,110 tons last year. It is probable that the figures for the second half of the current year will show a satisfactory increase in custom ore receipts as well as of the company's own ore, for several of the mines that were custom shippers last year up to the time of the outbreak of the war, but which shipped little, if any, ore during the first half of this year, are now either preparing to resume shipment of ore or have already

done so. Again, the company, having resumed work at its several mines in Ainsworth and Slocan divisions, may be expected to assist in making a better showing from those divisions during the remaining months of 1915. The increase this year from Rossland was altogether from the company's own mines, custom ore receipts from that camp having been nearly 2,000 tons less than in the first half of 1914.

The Granby Consolidated Co.'s mines are now shipping about 3,500 tons of ore a day to the company's smeltery at Grand Forks. The B. C. Copper Co. is stated to intend to have its copper smeltery at Greenwood in operation again before the close of July. The Jewel-Denero Mines, Ltd., continues to operate its Jewel gold mine and 15-stamp mill, situated near Long lake, eight miles from Greenwood. Prospecting work is being done on various mineral claims in Franklin camp, north fork of Kettle river. Farther west, up the west fork of the river, there has been a resumption of work on several properties, but not much ore is being mined there.

Hedley.—The outlook for the Hedley Gold Mining Co.'s Nickel Plate group of gold mines is stated to be better now than at any previous time in the history of this dividend-paying enterprise. More ore is in sight, and much of it above the average value of that mined there in recent years. The company is making important additions to the mill plant, a second tube mill and four large cyanide vats being included in the improvements being made. An extension of the mill building has been necessitated to provide for the additional plant. The company's hydro-electric power system put in last year has been giving satisfaction, everything connected with it having fully come up to expectations.

The Iron Mask Mine, near Kamloops, shipped between 200 and 300 tons of ore to Trail during six weeks to the middle of July.

The Monarch mine, near Field, on the C.P.R. main line, has been taken on lease or bond by some Vancouver men, who have already shipped a little ore from it to Trail.

Small lots of ore lately have been sent out from two mines in Trout Lake division, Lardeau district, but the production of that part of the province is not now nearly so large as it was some years ago.

NEW YORK

It is predicted that the American production of refined copper for the year 1915 will surpass the previous high year of 1912, when 1,253,000,000 lb. was obtained, and some authorities even say that the billion-and-a-half figure will be reached, in spite of the cutting off of Germany's quarter-of-a-billion-pound annual buying. Copper stocks are not booming abnormally [illegible] much higher than they would be usually with copper at 15 cents instead of 20 cents. It is considered that situation will not last.

The big Gary steel plant of the United States Steel Corporation, from practical idleness last winter is now climbing to nearly 100 per cent. capacity.

At the excellently-operated Newport iron ore mine at Ironwood, Michigan, a steam shovel loading ore from a stock pile during ten hours on a Saturday, recently filled 162 cars of nearly 8,000 tons capacity. Previous record on the Gogebic range was at the Colby mine, Bessemer, when 150 cars of an average of 42 tons to the car was loaded in 10 hours.

"Life," the American "Punch," and the most discerning of American weeklies, says, editorially: "The German situation is that of a bully, who, after forty years of incessant preparation, attacked Europe, was foiled in its first dash, has been held for a year from any decisive advantage, and is now struggling with every power it has to escape a just punishment for its intolerable aggressions." Again, "Uncle Sam is going to be neutral, no matter what happens—if every last cartridge goes to help the Allies, all the Germans leave the country, and Berlin surrenders."

Bethlehem Steel Corporation, which recently came into prominence in mining circles by its acquisition of extensive iron ore lands in Chile, whence it plans to bring ore through the Panama Canal to its plants in Eastern Pennsylvania, was nearly the only American manufacturer with equipment and ability for manufacturing munitions of war for several months from the outbreak of hostilities. It is estimated its common stock will earn 90 per cent. during 1915. In spite of the exceptional opportunities for war orders, most American manufacturers did not wake up to the situation until Bethlehem Steel Corporation had shown the way.

The American Institute of Mining Engineers is one of eight scientific associations which have been requested by Secretary of the Navy Daniels to name two members for the newly-created advisory committee on inventions, of which Thos. A. Edison is chairman.

The United States Steel Corporation, since its organization 14 years ago, has nearly doubled its capacity for manufacturing its different products, in spite of the fact that its officials have sought to be conservative, and have gone into new ventures with the utmost caution. Its pig iron capacity is now reported at 16,748,800 tons. Owing to Chairman Gary's objections war orders are being refused.

French ownership in American "porphyry" copper stocks is decreasing steadily through general liquidation of foreign-owned American securities.

John Hays Hammond, Jr., son of the world-famous mining engineer, who has been startling naval authorities with his inventions, is only 22 years old.

Thirty thousand five hundred miles, one-eighth of the railway mileage of the U. S. A., which has nearly one half of the world's length of track, is now in bankruptcy. The condition is partially due to overdoing the "big business" idea.

Spelter is in great demand, but zinc ore and concentrate are relatively plentiful. Smelters are overtaxed.

INTERNATIONAL NICKEL.

Accompanying activity and strength in International Nickel common are rumors that directors early next month will pay another 5 per cent. dividend on the common. In addition there is persistent talk regarding listing the company's stock on the Stock Exchange.

The company's business continues to increase from month to month, with June the best month on record, and the quarter ended June 30 showing earnings at rate of more than 20 per cent. per annum. Last year the company earned 18.31 per cent. on the common and paid 12½ per cent. in dividends.

The rapid increase in business is indirectly due to the war, which has caused abnormal demand for munitions and automobiles, in both of which nickel is used extensively. In addition the record high prices for copper, of which the company produced millions of pounds annually, have served to increase earnings.

MARKETS

SILVER PRICES.

	New York, cents.	London, pence.
July 10	47⅞	22¾
" 12	47⅝	22⅝
" 13	47⅜	22½
" 14	47½	22 9/16
" 15	47½	22 9/16
" 16	47⅝	22⅝
" 17	47½	22 9/16
" 19	47½	22 9/16
" 21	47⅜	22 9/16
" 20	47⅜	22 9/16
" 22	47¼	22 7/16
" 23	47⅛	22⅜

TORONTO MARKETS.

July 24, 1915 (Quotations from Canada Metal Co., Toronto)—
Spelter, 30 cents per lb.
Lead, 7 cents per lb.
Tin, 45 cents per lb.
Antimony, 40 cents per lb.
Copper, casting, 22 cents per lb.
Electrolytic, 22 cents per lb.
Ingot brass, yellow, 13 cents; red, 15 cents per lb.

July 24, 1915—(Quotations from Elias Rogers Co., Toronto)—
Coal, anthracite, $7.50 per ton.
Coal, bituminous, $5.25 per ton.

NEW YORK MARKETS.

July 22, 1915—Connellsville Coke (f.o.b. ovens)—
Furnace coke, prompt, $1.70 to $1.75 per ton.
Foundry coke, prompt, $2.10 to $2.40 per ton.
Tin, straits, 36.87½ cents.
Copper, Prime Lake, 19.12½ to 19.37½ cents.
Electrolytic copper, 18.75 to 19.00 cents.
Copper wire, 20.50 cents.
Lead, 5.75 cents.
Spelter, 19.75 to 20.25 cents.
Sheet zinc (f.o.b. smelter), 27.00 cents.
Aluminum, 32.00 to 33.00 cents.
Nickel, 50.00 to 52.00 cents.
Platinum, soft, $40.00 per ounce.
Bismuth, $2.75 to $3.00 per lb.
Quicksilver, $92.00 to $94.00 per 75-lb. flask.

STOCK QUOTATIONS.

(Courtesy of J. P. Bickell & Co., Standard Bank Building, Toronto, Ontario.)

July 23rd.

New York Curb.

	Bid.	Ask.
Alaska Gold	34.00	34.50
British Copper	.62½	1.00
Braden Copper	6.87½	7.00
California Oil	172.00	175.00
Chino Copper	44.62½	44.87½
Giroux Copper	.50	1.00
Goldfield Cons.	1.31¼	1.56¼
Green Cananea	40.00	42.00
Granby	84.00	84.50
Inspiration Copper	30.50	30.75
International Nickel	159.00	160.00
Miami Copper	26.75	27.00
Nevada Copper	14.25	14.50
Ohio Oil	134.00	136.00
Ray Cons. Copper	22.75	22.87½
Standard Oil of N. Y.	185.00	187.00
Standard Oil of N. J.	399.00	400 00
Standard Oil (old)	1325.00	.....
Standard Oil (subs)	925.00	.....
Tonopah Mining	5.50	5.75
Tonopah Belmont	3.62½	3.87½
Tonopah Merger	23.00	24.00
Yukon Gold	2.50	2.75

Porcupine Stocks.

	Bid.	Ask.
Apex	.02½	.03½
Dome Extension	.21½	.22
Dome Lake	.23	.23½
Dome Mines	22.50	23.00
Foley O'Brien	.28	.31
Hollinger	25.90	26.25
Jupiter	.10	.10½
McIntyre	.51	.51½
Moneta	.05½	...
Pearl Lake	.00¾	.01⅛
Porcupine Gold	.00½	.00¾
Porcupine Imperial	.06½	.06¾
Porcupine Crown	.70	.80
Preston East Dome	.03	.03½
P. Vipond	.62	.64
P. Tisdale	.01	.01¼
West Dome	.07	.07½

Cobalt Stocks.

	Bid.	Ask
Bailey	.02¾	.02¾
Beaver	.30	.35
Buffalo	.35	.50
Chambers Ferland	...	.16½
Coniagas	4.00	4.25
Crown Reserve	.45	.48
Foster	.04	.04½
Gifford	.01½	.02
Gould	.00½	.00¾
Great Northern	...	.02½
Hargraves	.01	.02
Hudson Bay	19.00	...
Kerr Lake	4.25	4.35
La Rose	.45	.55
McKinley	.20	.24
Nipissing	5.50	5.65
Peterson Lake	.22	.22½
Right of Way	.03½	.04
Silver Leaf	.02½	.03
Teck Hughes	...	.06
Temiskaming	.35¾	.36
Trethewey	11½	...
Wettlaufer	.03	.06
Seneca Superior	...	.95

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

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Most of the older reports are out of print, but they may usually be found in public libraries, libraries of the Canadian Mining Institute, etc.

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CANADA

Memoir 59. Coal Fields and Coal Resources of Canada, by D. B. Dowling.

Summary Report of the Geological Survey for the year 1914.

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Memoir 20. Gold fields of Nova Scotia, by W. Malcolm.

Memoir 60. Arisaig-Antigonish District, Nova Scotia, by M. Y. Williams.

Memoir 41. The "Fern Ledges" Carboniferous flora of St. John, New Brunswick, by Marie C. Stopes.

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ONTARIO

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Memoir 65. Clay and Shale Deposits of the Western Provinces (Part 4), by H. Ries.

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Museum Bulletin 11. Physiography of the Beaverdell Map Area and the Southern Part of the Interior Plateaus of British Columbia, by Leopold Reinecke.

YUKON AND NORTH-WEST TERRITORIES

Memoir 50. Upper White River District, Yukon, by D. D. Cairnes.

Memoir 67. The Yukon-Alaska International Boundary, between Porcupine and Yukon Rivers, by D. D. Cairnes.

MAPS RECENTLY ISSUED:

CANADA

Map 91A. Geological map of the Dominion of Canada and Newfoundland. Scale 100 miles to 1 inch

NEW BRUNSWICK AND NOVA SCOTIA.

Map 27A. Bathurst and vicinity, Gloucester County, New Brunswick. Geology.

Map 39A. Geological Map of Nova Scotia.

Map 121A. Franey Mine and Vicinity, Victoria County, N. S.

QUEBEC

Map 95A. Broadback River, Mistassini Territory, Quebec. Geology.

Map 100A. Bell River, Quebec. Geology

ONTARIO

Map 124A. Wanapitei (Falconbridge, Street, Awrey, and Parts of Maclennan and Scadding Townships), Sudbury District, Ont. Geology.

Map 49A. Orillia sheet, Simcoe and Ontario Counties, Ontario. Topography.

NORTH-WEST PROVINCES

Map 55A. Geological map of Alberta, Saskatchewan and Manitoba.

Map 117A. Wood Mountain Coal Area, Saskatchewan.

BRITISH COLUMBIA

Map 33A. Nanaimo sheet, Vancouver Island, British Columbia. Topography.

Map 70A. Victoria sheet, Vancouver Island. Geology.

Map 72A. Saanich sheet, Vancouver Island. Geology.

Map 109A. Prescott, Paxton and Lake Mines, Texada Island. Topography.

YUKON AND NORTH-WEST TERRITORIES

Map 113A. Canadian routes to White River District, Yukon, and to Chilkoot District, Alaska.

NOTE.—Maps published within the last two years may be had, printed on linen, for field use. A charge of ten cents is made for maps on linen.

The Geological Survey will, under certain limitations, give information and advice upon subjects relating to general and economic geology. Mineral and rock specimens, when accompanied by definite statements of localities, will be examined and their nature reported upon. Letters and samples that are of a Departmental nature, addressed to the Director, may be Mailed O.H.M.S. free of postage.

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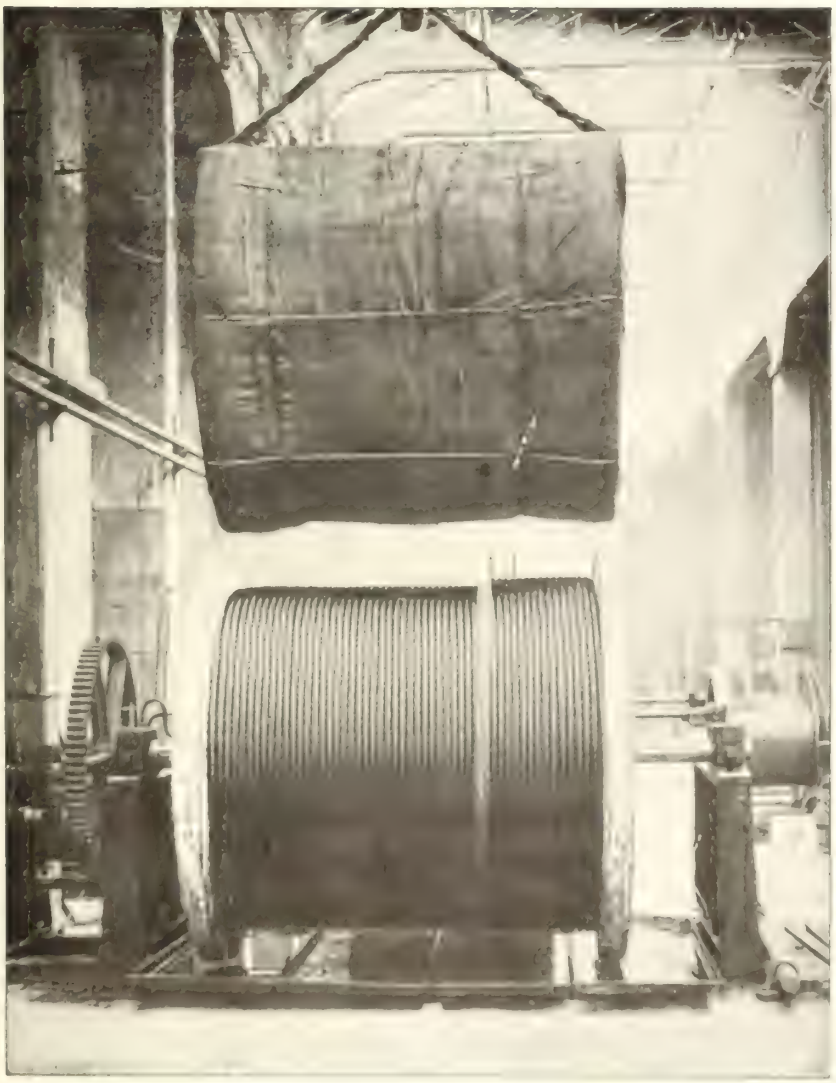

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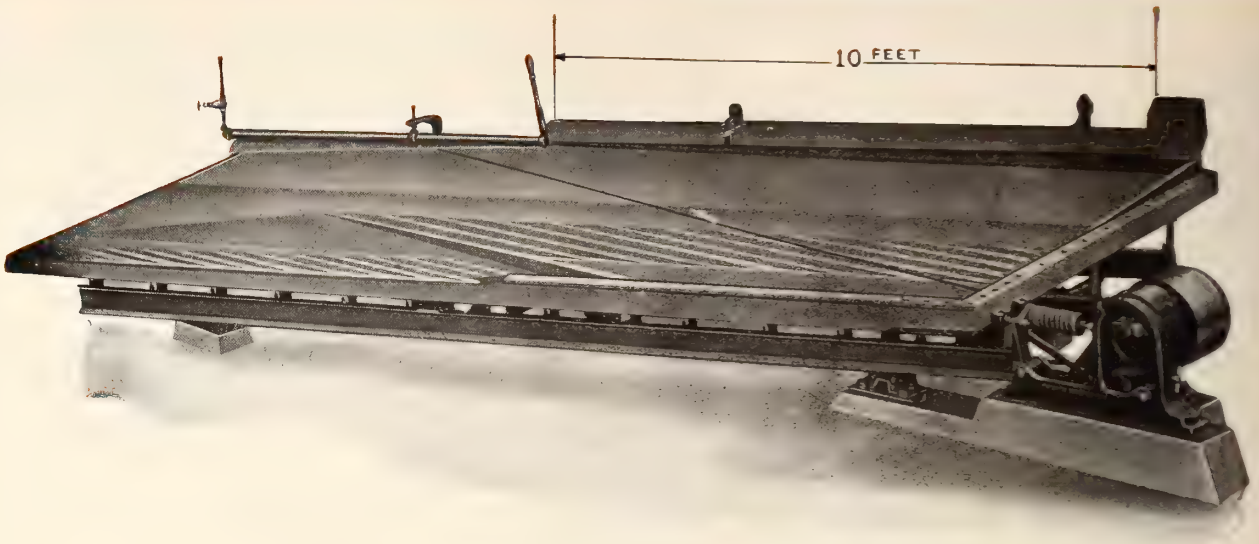

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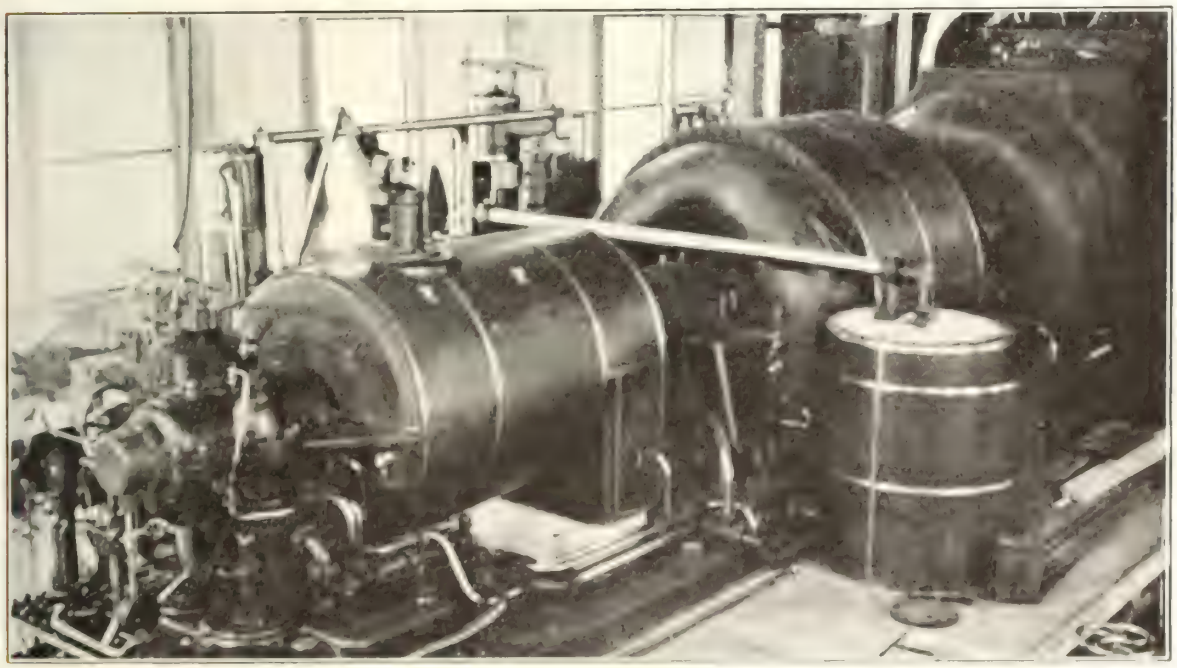

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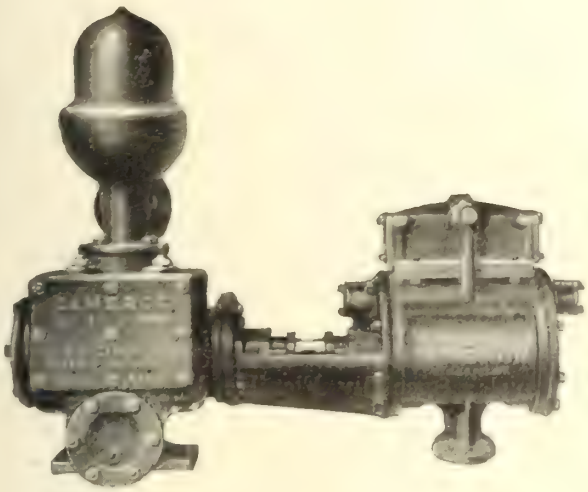

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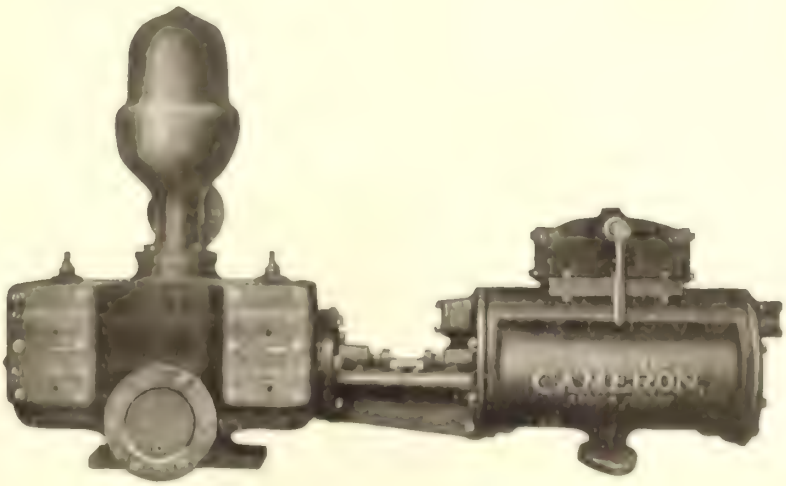

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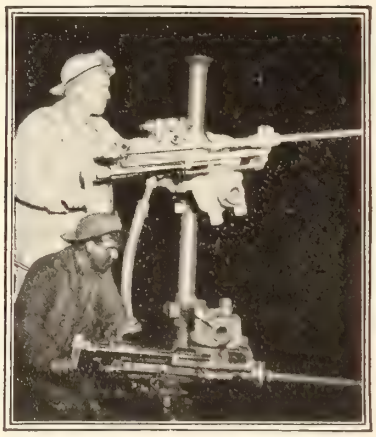

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Department of Colonization, Mines and Fisheries

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WORKING CONDITIONS. During the first six months following the staking of the claim, work on it must be performed to the extent of at least twenty-five days of eight hours.

SIX MONTHS AFTER STAKING. At the expiration of six months from the date of the staking, the prospector, to retain his rights, must take out a mining license.

MINING LICENSE. The mining license may cover 40 to 200 acres in unsurveyed territory. The price of this license is Fifty Cents an acre per year, and a fee of $10.00 on issue. It is valid for one year and is renewable on the same terms, on producing an affidavit that during the year work has been performed to the extent of at least twenty five days labour on each forty acres.

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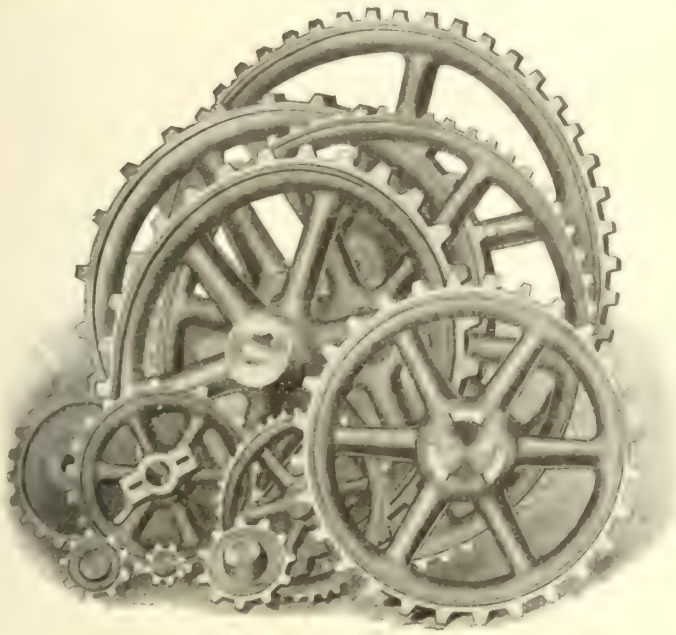

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COAL mining rights of the Dominion, in Manitoba, Saskatchewan and Alberta, the Yukon Territory, the North-West Territories and in a portion of the Province of British Columbia, may be leased for a term of twenty-one years at an annual rental of $1 an acre. Not more than 2,560 acres will be leased to one applicant.

Application for a lease must be made by the applicant in person to the Agent or Sub-Agent of the district in which the rights applied for are situated.

In surveyed territory the land must be described by sections, or legal sub-divisions of sections, and in unsurveyed territory the tract applied for shall be staked out by the applicant himself.

Each application must be accompanied by a fee of $5 which will be refunded if the rights applied for are not available, but not otherwise. A royalty shall be paid on the merchantable output of the mine at the rate of five cents per ton.

The person operating the mine shall furnish the Agent with sworn returns accounting for the full quantity of merchantable coal mined and pay the royalty thereon. If the coal mining rights are not being operated, such returns should be furnished at least once a year.

The lease will include the coal mining rights only, but the lessee may be permitted to purchase whatever available surface rights may be considered necessary for the working of the mine at the rate of $10.00 an acre.

For full information application should be made to the Secretary of the Department of the Interior, Ottawa, or to any Agent or Sub-Agent of Dominion Lands.

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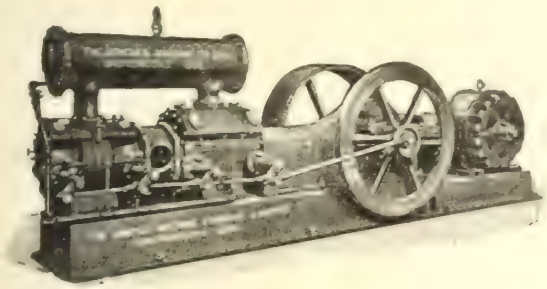

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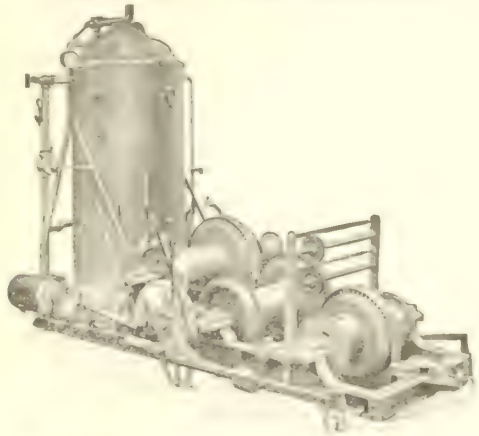

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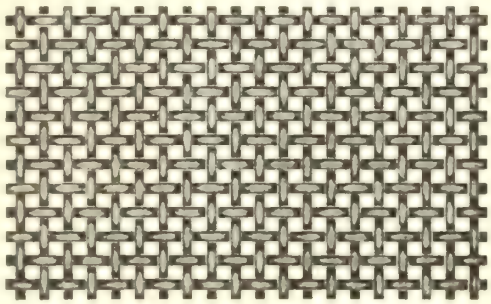

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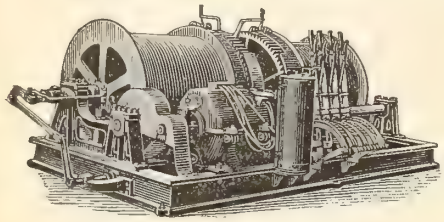

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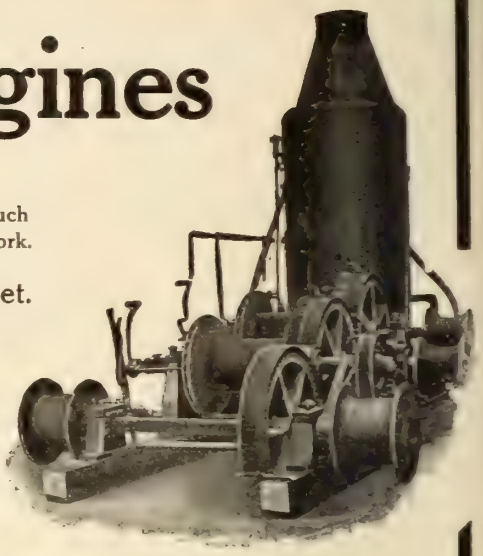

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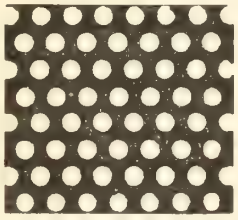

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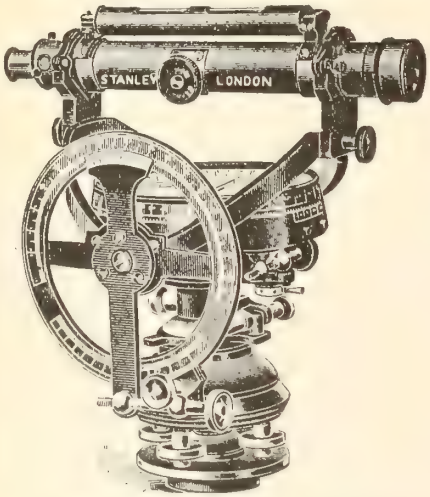

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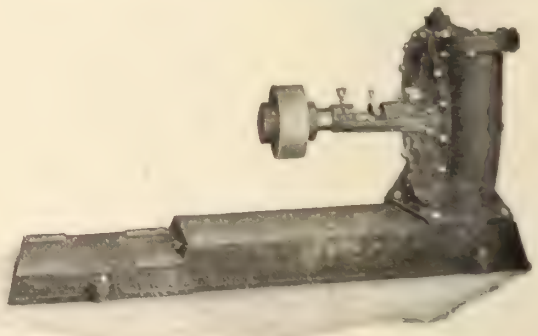

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Has produced Minerals valued as follows: Placer Gold, $73,269,603; Lode Gold, $81,595,516; Silver $37,709,282; Lead, $31,468,462; Copper, $86,939,370; Other Metals (Zinc, Iron, etc.), $2,198,949; Coal and Coke, $149,814,462; Building Stone, Brick, Cement, etc., $23,827,101; making its Mineral Production to the end of 1914 show an

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The substantial progress of the Mining Industry of this Province is strikingly exhibited in the following figures, which show the value of production for successive five-year periods: For all years to 1894, inclusive, $88,904,199; for five years, 1894-1899, $46,906,258; for five years, 1899-1904, $90,391,394; for five years 1904-1909, $121,618,733; for five years, 1909-1914, $139,002,161.

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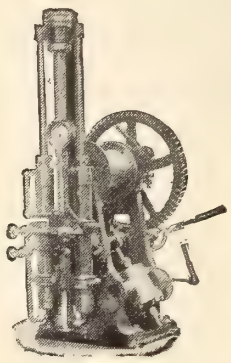

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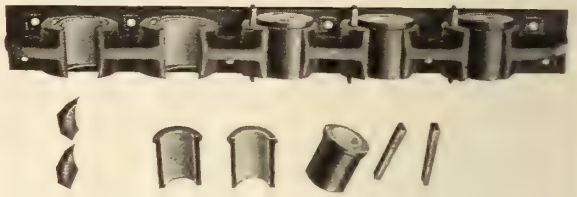

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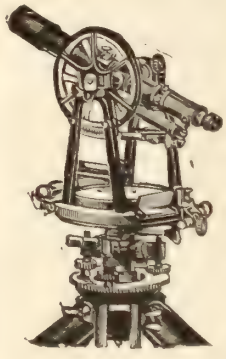

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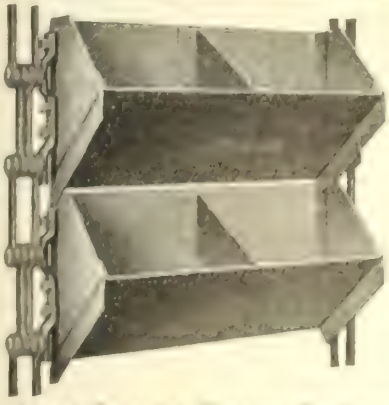

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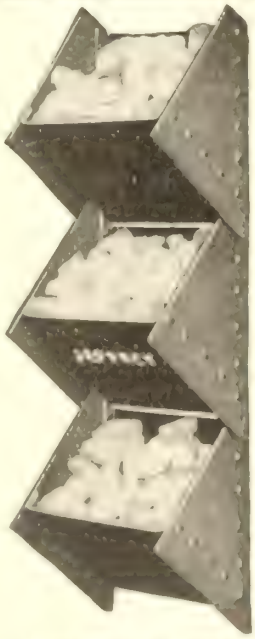

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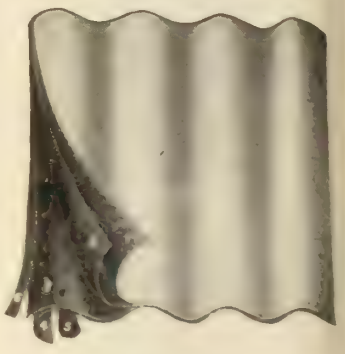

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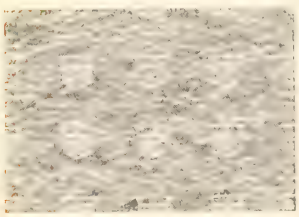

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THE CANADIAN MINING JOURNAL

VOL. XXXVI. TORONTO, Aug. 15, 1915. No. 16

The Canadian Mining Journal

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Editor

REGINALD E. HORE

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THE DISCOVERY OF CORUNDUM IN ONTARIO

Mr. H. M. Ami, in a letter to the Secretary of the Canadian Mining Institute, has some startling information concerning the discovery of corundum in Ontario. According to the late Dr. A. E. Barlow, the presence of corundum in the northern part of the county of Hastings, Ont., was really made known as the result of a visit made in October, 1896, by Mr. W. F. Ferrier, then lithologist to the Geological Survey of Canada. In the Summary Report for the year 1896 Mr. Ferrier relates the history of the discovery and the circumstances which occasioned his visit to that region. He writes: "One of the most interesting occurrences upon which I have to report is the recent discovery of corundum in Hastings county, Ontario. This came about in a somewhat unusual way. In 1893 I came into possession, by purchase, of a number of specimens collected by Mr. John Stewart, formerly of Ottawa, amongst them being a package labeled 'Pyroxene crystals south part of Carlow.' On examining these specimens some time ago I recognized them as corundum, and immediately took steps to ascertain, if possible, the precise locality from which they came. As you are aware, I communicated the facts to you and was authorized in October to visit the township of Carlow, endeavor to locate this mineral, and determine the extent of the deposit. I was accompanied by Mr. A. A. Cole, and after considerable difficulty found the mineral on lot 14, con. 14, of the township of Carlow, Hastings county, Ontario."

Previous to Mr. Ami's letter, the mining men of Canada have generally conceded the discovery of corundum in Ontario to Mr. Ferrier, and the later systematic investigation of the deposits to Dr. W. G. Miller. Now Mr. Ami, after an inexplicable silence of twenty-two years, rises to say that instead of being unknown in Ontario in 1893, corundum had been discovered, identified and even considered worth while to be mined at that time. He says that corundum from Ontario was exhibited at the World's Fair in Chicago in 1893, and that a card bearing the words, "Corundum Company of Ontario" hung over the exhibit. He says further:

"This report of the occurrence of corundum in southeastern Ontario as far back as 1893 was communicated to Mr. Ferrier and other mineralogists and geologists of the Geological Survey of Canada in the days of Dr. A. R. C. Selwyn. In consulting my notes taken at the World's Fair, Chicago, on specimens exhibited in the Mining Building with a view of ascertaining the mineral resources of the Dominion [illegible]

iar to the different geological formations constituting the earth's crust, I recently found the record of the occurrence of corundum in Canada obtained from the Ontario exhibit. This record antedates the time of the visit paid by Mr. Ferrier to the corundum locality, and his 'discovery' of the mineral in Ontario by three years."

In short Mr. Ami states that Mr. Ferrier's claim to the discovery of corundum in Ontario is as baseless as the Kaiser's claim to allegiance with God. Mr. Ferrier's former friends will be grieved to learn that they have been so long deceived in him. Possibly the Council of the Canadian Mining Institute will feel called upon to quietly get rid of the formerly honored member.

We may, however, be permitted to say a word in support of Mr. Ferrier. There was no Ontario exhibit of corundum at the Chicago Fair in 1893. The Corundum Mining Company which Mr. Ami speaks of as making the exhibit was formed in 1902. It is therefore possible that the misstatements made are in Mr. Ami's rather than in Mr. Ferrier's account.

An indication of the satisfactory demand for the nickel and copper ores of the Sudbury district is the rise this week of the stock of the International Nickel to a new high level. The Canada Copper and Mond Nickel Companies, operating in the Sudbury district, are making new records in production of nickel-copper matte.

The Overseas News Agency of Berlin claims a supply of 2,000,000 tons of copper available for war purposes in Germany. Considering that the annual production of Germany is about 25,000 tons and the annual imports about 200,000 tons, German publicists must be given credit for their magnificent imaginations.

The Timagami Forest Reserve is still the scene of mining activity. Among news items from Latchford are the resumption of operations at the White Reserve mine, Maple Mt., and the development of the Taylor property at Spring creek. Both are cobalt-silver deposits, discovered some years ago.

In the London "Globe," July 19, 1915, Mr. A. G. Charleton, Past President of the Institution of Mining and Metallurgy, makes a plea for efficiency in national service. In connection with the Registration Bill about to be put in force, he says: "I hold that the experience and mental capacity as well as the manual ability of each individual needs to be classified and card-indexed in order to secure the best results in national organization, and it is equally essential that use should be made of this information."

"It occurs to me that the provisions of the War Registration Bill will lose much of their value unless the 'forms' that are to be employed serve to distinguish and separate sheep from goats, sinews from brains, so that the forces of the Empire can be applied properly and effectively to National Service in the best possible manner; that is to say so to apportion the work assigned to each individual in a public capacity that each one is best qualified to undertake with most advantage to the State, without detriment to national interests in other ways, by removing him from other work of perhaps greater national utility, indirectly, which he may be capable of performing in a private capacity."

The authorities have a big problem before them in classifying the men. Those who have had experience in the recently popular efficiency campaigns should be able to render special service in making the registration an intelligent one.

According to Mr. N. E. Hawco, superintendent of the construction of the terminal works at Port Nelson, the entire right of way for the Hudson Bay Railway, from Le Pas to Port Nelson, has been cut. Grading is completed for two-thirds of the way and steel laid for over 200 miles. Grading is to be completed by Christmas and steel laid next spring.

While primarily a grain route, the Hudson Bay Railway should play an important part in the development of Canada's mineral resources. Other railways in the Dominion are very largely responsible for the opening up of important mining camps. In Ontario Sudbury and Cobalt are shining examples.

Ottawa again sends out unofficial reports regarding the establishment of copper and zinc refineries in Canada. It is stated that both metals will be treated at Trail, B.C. The greater Government interest in metal refining that has been in evidence since the war began is likely to eventually result in some such move.

Welland reports the taking over a plant by that town for the treatment of zinc ores by an electrolytic process. The statement that the Weedon Mining Co. is behind the enterprise indicates that the zinc and lead deposits of Montauban township, Quebec, will be extensively worked. During the last few months of 1914, the Weedon Company was actively engaged in putting their newly acquired property into shape for production.

The price of silver is improving again, and with it the hopes of the owners of Cobalt silver stocks. The market until lately was so regularly downward that the policy of holding bullion for better prices was easily attacked by pessimistic stockholders. The directors responsible for the policy can rest a little easier now.

New York reports the arrival of $100,000,000 by express from Halifax "in a special car heavily guarded." Considering the weight of that amount of gold, the reporter might have been pardoned for giving some details about the construction of that car.

TORONTO EXHIBITION.

There was never a time in the thirty-seven years of its history when the Canadian National Exhibition promised more real instruction and entertainment than this year. In addition to the marvelous proofs of the manner in which the patriot at home is taking care of his responsibilities in the way of increased production that the patriot at the front may have the wherewithal to keep his place in the battle line, there will be special features of patriotic and historic significance.

The big war spectacle in front of the grand stand will be quite the most elaborate pageant ever presented by the Fair; while the Model Military Camp, aeroplane flights and the mining and torpedoing of ships in the harbor, supplemented by the war trophies, will be a revelation.

The new Giant Midway, with its army of spielers, never presented a more diversified list of attractions, while the Hippodrome and Circus in front of the grand stand will be a triumph in the amusement line. The Fair this year in all departments promises to excell any previous one ever held at Toronto.

The directors are looking forward to a repetition of the "Million Year" and are planning their program on a scale to fit this immense attendance.

The engineers recommended to the Militia Department as mining instructors have been attached to the following camps: Mr. James McEvoy, with the rank of captain, Niagara and London, Ont.; Mr. Walter Herd, with the rank of captain, Valcartier camp; Mr. E. D. Black, with the rank of captain, Sewell camp, Sask., and Mr. F. A. Fortier, with the rank of lieutenant, Barriefield camp.

INTERCOLONIAL COAL.

A special general meeting of shareholders of the Intercolonial Coal Mining Co., Ltd., will be held at the head office, Room 413, Dominion Express Bldg., Montreal, on Nov. 25, for the purpose of empowering the issue of $100,000 debentures of the company and authorizing the making of a mortgage to the Government of Nova Scotia to secure their guarantee of said debentures and of authorizing the issue of bonds to retire certain outstanding bonds and the security for the same and generally to take such other steps as may be necessary in connection with said proposals.

A press despatch sent out West from Ottawa states that the Government has decided that mining leases in the West, including British Columbia and the Yukon, held by men who are enlisting to go to the front, shall be exempt from payments while the holders are absent at the war. This is misleading so far as British Columbia is concerned, since the Dominion Government has no control over matters relating to mineral claims and leases in that Province. There is no doubt, though, that the Hon. the Minister of Mines for British Columbia will see to it that no loss will result to any man holding a mineral claim, placer lease or any other right to mining property in the Province, by reason of his having gone on active service in Europe or on any military duty in the Dominion or Bermuda.

From South Africa has come the news that the Chamber of Mines at Johannesburg has given a donation equivalent to about $150,000 for a Union of South Africa hospital ship, a field hospital, or for any other relief purpose to which General Botha shall decide to apply it.

THE CAPE BRETON HIGHLANDER'S SOLILOQUY

By F. W. Gray.

Why should I to the wars?
Why leave the lakes and pleasant hills,
Of this, my native Isle?
Where 'neath the thick spruce shade
I've found the ghost-like "Indian Pipe",
And rested me awhile.
Why should I to the wars?

Here each recurrent spring,
I've seen the stately iris bloom,
And the wild roses blow.
Have marked the lily pool,
And glimpsed along its flag-starred marge,
Wee violets hidden low.
Why should I cross the seas?

Why should I leave Strathlorne?
Loch Lomond, Uist, and Glen of Skye,
For France to journey forth?
Why should I bid farewell
To loch and ben, to beck and glen,
From Canso to Cape North?
Why should I to the wars?

Because across the seas
There lie the scattered Western Isles,
Whence my forefathers came,
They built their shielings here,
And, thinking on the Isles they loved,
Gave each a Highland name.
How could their sons forget?

Because across the seas,
Dead on the field of honor lie
Men from the Highland glen,
The Sassenach by kilted Gael,
Many brave Gentlemen,
Proud of their Highland name.

Here where the spruce and moose-grass grow,
As where the heather flames,
So go we forth to France;
And Hark! it calls our names!

Renewed the war-cry of Gael,
His coronach and fate,
His eagles from our Gate.

McINTYRE AND PEARL LAKE MINES.

Production of McIntyre gold mine for the month of July was as follows:

Tons milled, 9,410; value per ton, $789; gross value, $74,245; recovery, $71,600 = 96%; total costs, $44,000 = $4.70 per ton; net profit, $27,600.

In a statement issued August 6, President A. M. Hay says:

The operating cost is higher than last month owing to the expenditure on shaft sinking and other extensive development, all of which is charged against the tonnage milled. On the 500 ft. level at a distance of 60 feet south from No. 5 shaft, a body of ore about 20 feet wide was intersected, and drifts have been run east and west for a total distance of about 175 ft., from which ore has been mined, giving an average assay value of $9.00 per ton over the full width of the drifts. No. 5 shaft is now down to a depth of 600 ft., and a station is being cut at that level. As soon as the workings are sufficiently advanced, sinking will be resumed to the seventh level.

Owing to the satisfactory nature of recent developments, arrangements are now being made to increase the capacity of the mill to 400 tons per day, by making additions to the cyanide plant, at a comparatively moderate cost. The crushing and milling capacity will be further increased as may be warranted by future developments.

During the month a controlling interest in the property formerly owned by the Pearl Lake Gold Mines, Limited, has been acquired by the McIntyre company on very advantageous terms, securing for it the privilege of utilizing the Pearl Lake shaft and workings in carrying on mining operations on the McIntyre property. The Pearl Lake property consists of 127 acres immediately adjoining the McIntyre locations, and is situated in a formation favorable for the occurrence of gold veins.

The operation of raising ore while sinking No. 5 shaft below the 500 ft. level is already seriously taxing its hoisting capacity. Being a two compartment shaft, only one is available for hoisting (the other being used as a manway), and 700 ft. will be the limit of depth to which it can be efficiently operated. The company had, therefore, to face in the near future an expenditure for sinking and equipping a working shaft to take care of ore from the deeper levels. The Pearl Lake shaft, which is situated only 301 ft. from the McIntyre boundary line, is already down to a depth of 665 ft. It is exceptionally well timbered and equipped with an electric hoist good for operations to a depth of 1,000 ft., and having three compartments, two will be available for hoisting, etc., so that it will serve as a main working shaft for deep mining operations on both properties.

It is proposed to resume sinking this shaft and to make connection with the McIntyre workings at the 700 ft. level, so as to provide ventilation when that depth is reached by No. 5 shaft.

The Pearl Lake property is also well equipped with buildings and plant, including an electrically driven compressor which, for some time past, has been rented by the McIntyre company for its operations at No. 5 shaft.

The terms under which the property and assets of the Pearl Lake Company have been acquired from the assignee are briefly as follows:

A new company has been formed under the name of the McIntyre Extension Mines, Limited, with a capital of 2,500,000 shares of the par value of $1.00 each, of which 500,000 shares are placed in the Treasury.

Payment has been made by the McIntyre company of $47,733.30 in satisfaction of all claims of creditors of the Pearl Lake Company (with the exception of the claim of B. E. Cartwright) for which payment the McIntyre Company received 1,020,000 shares of the McIntyre Extension Company, Mr. Cartwright receiving 980,000 shares in satisfaction of his claim of $175,000.00 for monies advanced by him to the Pearl Lake Company as admitted and passed by the assignee. A further payment of $2,500 was made to Mr. Cartwright by purchasing from him 25,000 shares of his holdings in the Extension Company at ten cents per share in order to enable him to satisfy certain claims which, if not then disposed of, would have delayed the closing of the deal and might have involved a serious loss of time, which it was desirable to avoid in order to expedite development on the McIntyre property as above outlined.

The McIntyre Company has agreed to expend $18,000 for development work on the Extension property which, at the option of the McIntyre Company, may be expended over a period of eighteen months at the rate of $1,000 per month. For such expenditure the McIntyre company is to receive treasury shares of the Extension Company at the price of ten cents per share. Two offers have been received to purchase all or any portion of the treasury shares of the Extension Company at ten cents per share, so that this obligation is unimportant. It is not, however, the intention of the directors to offer any of the Extension Company's shares for sale at present. Should it be found expedient to do so later on, the treasury stock will be sold to the best advantage. Prospecting and development work on the Extension Company's property can be undertaken at a minimum of expense from the McIntyre workings some of which are within 100 ft. of the boundary line, and in the event of such development proving satisfactory, the large shareholding of the McIntyre Company in the Extension Company should become a valuable asset.

ELECTROPLATING WITH COBALT.

A paper by C. H. Buchanan and Thomas Haddow prepared for the New York Branch of the Electroplaters' Society, contains data and results of experiments covering a long period, made by the writer, C. H. Buchanan, and a report of experiments of recent date in collaboration with Thomas Haddow. Early experience showed that a chloride-cobalt solution deposited more rapidly than did a nickel solution. Subsequent work done with cobalt proved so satisfactory that if the cobalt metal could have been obtained in sufficient quantities from commercial sources, even at a cost higher than paid for nickel, it would have been adopted for general work. The results of recent tests are summarized as follows: Cobalt plating has a beautiful bluish-white color. The deposit does not tarnish as readily as nickel; it is homogeneous, with a fine, close grain; it is smooth and not brittle, and will easily withstand bending tests. The time required in order to secure a satisfactory deposit is much less with cobalt than with nickel, and the current density with cobalt may be greater. Metallic cobalt costs more than nickel, but the cost of the salts is of small importance in a comparison of the two as to economy in results. Because of the greater conductivity of cobalt as compared with nickel, a current of higher density may be used in combination with a solution of less concentration. The time required in the solution is, with cobalt, one-third that required for nickel, and there is a similar saving of time in the buffing room. The substitution of cobalt for nickel would thus greatly increase the speed of production in any established plant.

RECRUITING AMONG THE MINERS OF NOVA SCOTIA

By F. W. Gray.

By the courtesy of the several coal companies in Nova Scotia it has been possible to compile statistics on recruiting among the coal miners of Nova Scotia which may be of interest to the readers of the Journal.

The number of men who have joined the Canadian Overseas Contingents, the Militia forces for local defence or in training, and reservists and volunteers to the armies of the Allies is as follows. British reservists who reported for duty in Britain are included in the heading "British Forces":

	Forces of the Allies.	British Forces.
Cape Breton Island—		
Dominion Coal Company	540	450
Nova Scotia Steel & Coal Co.....	25	190
Inverness Coal & Railway Co. ..	17	56
Small companies	..	6
	582	702
Nova Scotia Mainland—		
Springhill Mines	100	165
Intercolonial Coal Co.	1	77
Acadia Coal Company	25	37
Minudie Coal Co.	15	25
Maritime Coal & Railway Co. ..	1	21
	142	325
	724	1,027

Total of approximately 1,750 men.

Allowing for certain adjustments from the figures given in the Nova Scotia Mines Report, the number of employees at the mines in Nova Scotia at the outbreak of war would be approximately 13,500 men, so that the enlistments have been at the rate of thirteen per cent., a figure that speaks for itself.

The writer has no figures relating to the total of enlistments in Nova Scotia, but accepting usual standards of the relation borne by military effectives to the total population, the 460,000 persons who form the population of Nova Scotia should furnish about 60,000 men of military fitness. A rate of enlistment of 13 per cent. would yield therefore from 7,000 to 8,000 recruits in the province. It is certain that nothing like this number of recruits has offered.

In considering Nova Scotia enlistments, however, it must be borne in mind that the young men of Nova Scotia have for many years been moving West, or to the New England States. It is probable that a dissection of the enlistments in Nova Scotia would show a relatively larger percentage of enlistments among Canadian-born men than is the case in the Western Provinces. This is naturally the case because of the quite recent settlement of many parts of the Canadian West.

From the figures just quoted, it is quite evident that the coal miners of Nova Scotia have proved their right to share in the general distinction that coal miners have achieved in this war. The record of the coal miners is strikingly summed up by Mr. Lloyd George in his speech on the question of munitions delivered in the House of Commons on the 23rd June last, from which the following extract is quoted:

"The way in which the miners have come forward to enlist in our armies voluntarily is one of the most conspicuous exhibitions of patriotic sacrifice that has been exhibited by almost any trade in the country. I believe that about 224,000 of them are enrolled in our armies at the present day, and I was told by men whom I have seen at the front that no men have exhibited more desperate valor under trying conditions than the miners who have come from different parts of the country."

The rate of enlistment among the miners of Britain has been authoritatively quoted as being ten per cent., and it was found necessary in some of the colliery districts to discourage recruiting because of the consequent disorganization of the industry. The greater willingness of the married men to enlist has been characteristic of the recruiting among miners both in Great Britain and in Nova Scotia. This may be partly explained by the fact that the miner as a rule marries early in life. There is also, maybe, a subtler reason, and one that finds its source in the psychology of the miner's wife. The bravery of the miner's women folk needs neither emphasis or encomium to those who know them intimately, and in any meed of praise justly given to the miners of the Empire for their ready and willing response to recruiting appeals in every corner of that Empire, the brave part played by the miner's wife must not be forgotten.

The work of the coal miner develops certain characteristics that peculiarly fit him for the trench warfare that has played so great a part in the fighting in Flanders. One officer, in speaking of the miner's battalion, stated that the miner made a good soldier because of his ability to withstand cold and damp and fatigue, because of his "strong back," his understanding of excavation and the nature of ground, his familiarity with explosives, his "curious ear" for suspicious sounds, and his general contempt for danger. This officer remarked that miners did not make "parade soldiers," particularly in the case of the older men whose figures were set, but he did not think that the Germans had noticed the difference. In the matter of listening the miner should excell, as under working conditions his life will sometimes depend on his ability to correctly diagnose the meaning of sounds in the roof and timbers.

The use of poisonous gases by the Germans has brought another feature into the war that presents problems not unfamiliar to the coal miner.

OBITUARY

Mr. Aubrey white, Deputy Minister of Lands and Forests for Ontario was one of the best known forestry men on the continent. The late Mr. White was born in Ireland in 1845 but came to Canada as a young lad of seventeen, and engaged in the lumber business in Muskoka. His lumbering experience brought him in touch with the Crown Lands Department, and he became a Crown Land Agent, later entered the Forestry Department of the Ontario Government, where he eventually became Deputy Minister of Lands and Forests. He was an ex-president of the Canadian Forestry Association and recognized throughout the continent as an authority on forestry problems and conservation matters.

ANNUAL REPORT OF MINISTER OF MINES OF BRITISH COLUMBIA FOR 1914

The Annual Report of the Minister of Mines for British Columbia for the calendar year 1914 has been issued. It is the most bulky and comprehensive report yet prepared by the provincial mineralogist, Mr. Wm. Fleet Robertson, and will doubtless be found very useful by all interested in mining in the province who shall peruse its contents.

In his letter of transmittal, Mr. Robertson makes the following comment: "The statistical tables give the total mineral output of the Province to date, and show in considerable detail the actual mineral production of the past year, as based on smelter or mill returns; also, a summary of the production of each of the last four years, thus illustrating by comparison the progress made in productive mining during this period. To facilitate comparison with information previously given, I have retained, as closely as was possible, the general form already established for such tables and for the report."

Total Mineral Production of British Columbia.

The first table shows that the total value of the mineral production of the Province for all years to 1914, inclusive, has been $486,822,745, in the following proportions:

Gold, placer	$73,269,603
Gold, lode	81,595,516
Total gold	$154,865,119
Silver	37,709,282
Lead	31,468,462
Copper	86,939,370
Zinc and other metals	2,198,949
Total metalliferous	$313,181,182
Coal and coke	149,814,462
Building stone, brick, etc.	23,827,101
Total non-metalliferous	$173,641,563
Total value of mineral production	$486,822,745

Value of B. C. Production in 1914.

The value of the production of the year 1914 was $26,388,825. This compares with $30,298,398 in 1913, and $32,440,800 in 1912. No other year than those two, however, had as high a value to its credit as did 1914. The decrease in 1914 was caused partly by a lessened production as a result of the war in Europe and to a smaller extent by lower average prices for the year of all the included metals except gold. Lower prices caused a decrease in total value, as compared with 1913, of $1,170,117, or nearly one-third of the amount of the decrease. The quantities and value of the production in 1914 are as under:

	Quantity.	Value.
Gold, placer, oz.	28,250	$565,000
Gold, lode	247,170	5,109,004
Total gold		$5,674,004
Silver, oz.	3,602,180	1,876,736
Lead, lb.	50,625,048	1,771,877
Copper, lb.	45,009,699	6,121,319
Zinc, lb.	7,866,467	346,125
		$15,790,061
Coal, tons of 2,240 lb.	1,810,967	6,338,385
Coke, tons of 2,240 lb.	234,577	1,407,462
Miscellaneous products		2,852,917
Total value of production in 1914		$26,388,825

The provincial mineralogist has included in the report an interesting summary of the progress of mining, a brief review of the work done during the year by himself, Mr. J. D. Galloway, assistant mineralogist, D. E. Whittaker, assistant provincial assayer, and by the Board of Examiners for coal mine officials; also reports by several mining engineers on parts of the province, the investigation of mining conditions and properties in which was specially assigned to them, respectively. The customary annual reports of gold commissioners and mining recorders occupy many pages, and these are supplemented by notes by the provincial mineralogist. The reports of the chief inspector of mines, Mr. Thomas Graham, and the district mine inspectors give much valuable information, and in this connection may be mentioned the information concerning progress in instruction among both metalliferous and coal miners in first-aid to the injured, the use of oxygen-breathing apparatus in mine rescue work, and the application of the pulmotor for automatic resuscitation. Another useful feature is the provincial mineralogist's review of coal mining, together with the reports of the district inspectors on individual collieries.

The reports of the several mining engineers, with the exception of that of Mr. J. W. Astley, on parts of Nanaimo mining division, had already been issued in bulletin form. Their inclusion in the Annual Report, though, contributes materially to its completeness. Mr. W. M. Brewer reported on Atlin, Queen Charlotte and Skeena mining divisions, the last-mentioned only in part. Mr. N. W. Emmens reported chiefly on Lardeau and Trout Lake mining divisions. Mr. A. G. Larson, who was assisted by Mr. C. S. Verrill, reported on the mineral and other resources of the North Fork of Kettle River, in Grand Forks mining division. The assistant mineralogist contributed a lengthy report on Omineca mining division along the Grand Trunk Pacific Railway from New Hazelton eastward, and notes on Cariboo and other parts of the province he visited during the year.

Numerous half-tone reproductions of photographs add greatly to the general attractiveness of this carefully prepared report. In particular those showing British Columbia mineral exhibits at the Panama-Pacific International Exposition are worthy of commendation, while views of parts of mining districts, and others of individual mining properties convey an excellent idea of local conditions. Maps and diagrams also add to the practical usefulness of the report, information in which is rendered readily accessible by a full and a carefully prepared index. The report may be obtained gratis on application to the Department of Mines, Victoria, B.C.

THE BUYING AND SELLING OF METALLURGICAL PRODUCTS

The Buying and Selling of Ores and Metallurgical Products is the title of Technical Paper 83, just issued by the Bureau of Mines. Charles H. Fulton, the author, says:

The buying and selling of ores and metallurgical products is a great and highly important business in the United States, and one that concerns not only the miner and the metallurgist but the industrial world in general. In this paper the attempt is made to outline clearly its underlying principles, the subject matter being based on personal experience and investigation. The author has endeavored to present the material impartially, and for that reason many of the statements and figures regarding metallurgical practice should be taken as illustrative rather than as applying exactly to average operating conditions. Moreover, the statements as to metal prices and trade methods are to be considered as applying to normal business, not to special conditions that have developed as a result of the war in Europe. As regards the style, technical words and phrases have been avoided as much as possible in order to make the paper easily understood by anyone who might be interested.

In estimating the value of an ore or an intermediate metallurgical product (other than a refined metal), the basis used is the price of the refined metal at some principal market centre, such as New York, at the time the valuation is made. The average price of all copper for 1913 was 15.5 cents per lb., and for electrolytic copper 15.269 cents per lb. The prices for other metals for the year 1914 were as follows:

Lead, 3.862 cents per lb.; spelter, 5.213 cents per lb.; silver, 54.811 cents per troy oz. Gold has the standard value, established by law, of $20.67 per troy oz.

If the metal contents, in pounds for the base metals and in troy ounces for the precious metals, per avoirdupois ton be multiplied by the prevailing price of the refined metals, the sum of the products will be the gross value of the ore.

There is, however, a wide difference between the gross and the net value of a ton of ore. From the gross value must be deducted, first, the total cost of mining the ore, and then the smelter or charge for treatment, which includes some or all of the following items: Freight to treatment plant, milling or smelting charge, charge to compensate for losses of metal in treatment, charge for penalties imposed on undesirable constituents in the ore, charge for freight to refining center, charge for selling the metal, charge to cover the selling cost of the refined metal.

Which of these charges are imposed and what the amount of each charge is depend on the ore, the method of treatment, and the number of firms that handle the ore and metals in the process from ore to refined metal.

The types of companies that handle ores and metallurgical products may be classified as follows:

1. Mining and smelting companies or mining and milling companies which control all the operations from the mining of the ore to the production and selling of the finished metal.

2. Mining companies, which mine and sell ore on certain schedules to smelting or selling companies.

3. Custom smelters or mills which purchase ores and also operate refineries and produce refined metals or sell intermediate metallurgical products to refineries.

Concerns of type 3 may control mines that furnish a part of their ore supply.

4. Refining companies, which purchase metallurgical products, such as matte and crude metals and some ores, and produce refined metals.

5. Selling agencies, which place the refined metals on the market.

It is apparent that an ore or the products derived from it may go through many hands before the finished metal reaches the market, and that metallurgical business may be complex. In this report the essentials of the commercial side of metallurgical work are discussed in some detail.

Copies of this technical paper may be obtained free of charge by applying to the Director of the U. S. Bureau of Mines.

M. J. O'BRIEN.

Mr. M. J. O'Brien's activities in mining districts have made his name a familiar one to mining men. Our readers will doubtless be interested in the following appreciation which appeared in "The Financial Times" Saturday, July 31:

Among the many Canadians who have risen from comparative obscurity to a position of affluence and power through sheer ability and enterprise, the name of Michael J. O'Brien stands out prominently. Starting the battle of life at the early age of fourteen years, in railway construction work, M. J. O'Brien is to-day ranked among the leading capitalists of the Dominion.

Of Irish descent, his immediate ancestors having come from Waterford, Ireland, M. J. O'Brien was born in 1851 in Antigonish, where his father successfully conducted a store, and there he attended the Public School of his native town.

Starting work early, as already indicated, he successively passed through every position in connection with railway construction work, such was his ability, industry and thoroughness, until finally he became superintendent of construction. From the pay roll of another contractor to the establishment of a railway contracting business of his own, was the next step in the career of the man who was destined to become one of the most influential personages in the country. The qualities which had marked him out for advancement while working under supervision stood him in good stead in the conducting of his own enterprise and he soon became noted and esteemed as a careful and thoroughly conscientious constructor of railways.

His first big work was undertaken in 1881 when associated with the firm of Messrs. Chisholm and O'Brien, this firm afterwards becoming M. J. O'Brien and Company.

From the inception the enterprising young Irish Canadian met with success. He entered into contracts with many Canadian railway companies for construction work and during the busy time of such industry in Canada accomplished many gigantic tasks.

Among the railway enterprises with which Mr. O'Brien has been connected during his long and successful career may be mentioned sections of the National Transcontinental, the Canadian Northern Quebec, the Quebec, Montreal and Southern, the Quebec and Lake St. John, the Kingston and Pembroke as well as many others.

The section of the National Transcontinental with which Mr. O'Brien was connected were some eight hundred miles in length, about half of the work being in the Province of Ontario and the other half in the Province of Quebec.

In the past twenty years or so other enterprises have attracted the attention of Mr. M. J. O'Brien and he has been uniformly successful in each of them. He is interested in mining and has large interests in gold mines in Nova Scotia and gold and silver mines in Mexico.

His greatest successes in the mining industry, however, have been in connection with properties in the Cobalt district. The O'Brien mine, which he owns, is generally considered to be one of the richest of the Cobalt properties. Mr. O'Brien has also extensive interests in the field around Gowganda. Amongst others he owns properties known as the Miller-Lake-O'Brien and Millerette mines.

Other enterprises of a more varied nature in which Mr. O'Brien is interested include timber limits in the Province of Quebec, one of them being 1,125 square miles in extent, including a water power on the Quinze River. He also owns and operates large farms located in Alberta, Saskatchewan and Ontario.

In addition Mr. O'Brien holds extensive interests in various industrial concerns scattered throughout the country.

The town of Renfrew, Ont., holds M. J. O'Brien in high esteem. In the days when success first smiled on him he made his home in that place, and has ever since retained a connection of a warmer character than that of merely a ratepayer and property owner, being heavily interested in the Renfrew Machinery Co., Limited, manufacturers of cream separators; Logan Brothers, Limited, producers of all manner of woollen goods, etc.

Mr. O'Brien is also an officer and director in many other companies including the Capital Trust Corporation, Limited, and Capital Life Assurance Company, of Ottawa; Deloro Mining and Reduction Company, Limited, at Deloro, Ont.; Strome Milling and Grain Co., Limited, Strome, Alta.; Great Lakes Dredging Company, Limited, Port Arthur.

Mr. O'Brien is associated at the present time in the construction of one of the most important sections of the Welland Canal.

Despite his many and varied activities Mr. O'Brien has found time to devote to the public interest. From 1902 to 1905 he was a commissioner of the Province of Ontario, and has held other public offices.

Particularly interested in the breeding of horses the Canadian National Bureau of Breeding, which aims at improving the breed of farm horses throughout Canada by an infusion of the blood of the thoroughbred, found a warm friend and supporter in him from its inception in the face of considerable prejudice and some opposition.

Mr. O'Brien is a member of the Engineers' Club of Montreal and the Ontario Club, Toronto.

He was married at Renfrew, Ont., in 1883 to Miss Jennie Barry, and has three sons and four daughters.

KENNECOTT COPPER CORPORATION.

The Boston Commercial recently printed information concerning the Kennecott Copper Corporation, which owns and for several years has been operating copper property situated in the eastern part of Alaska. The information follows:

During the four and a half years of existence of this company it has produced about 100,000,000 lb. of copper. The average cost of production has been under 5 cents a lb., to be accurate 4.72 cents. This production has been chiefly from one mine, the Bonanza, which has been developed to the 600-ft. level. Since the first of this year the company has opened another mine, known as the Jumbo, and has increased the size of its concentrating plant.

President Birch, in discussing the matter, has been quoted as having said: "Our production of copper has been increased to about 5,000,000 lb. a month, or 60,000,000 lb. a year.

"We have taken over the Beatson copper mine, which is a low-grade property. More than 85 per cent. of the stock of the Beatson Copper Company is held in the treasury of the Kennecott Copper Corporation. This company has been in operation for more than four years; we have just completed construction of a concentrating plant and we estimate that the production from this source will be about 10,000,000 lb. of copper a year.

"We mine two grades of ore, namely, a high-grade pure chalcocite running about 70 per cent. copper, and a low-grade ore which averages about 12 per cent. We now have blocked out ore sufficient for six and one-half years. In deep vein mines, such as those owned and operated by the Kennecott Copper Company, it is not usual to keep blocked out more than two or three years' ore ahead of operations."

President Birch has supplied figures showing the production and net returns of the Bonanza mine during its four and a half years of operation. These figures show that since 1911, the year this property was acquired by the company, there has been produced nearly 90,000,000 lb. of copper which has been sold at an average price of 14.15 cents a lb. and has netted to the company $8,121,000, as shown in the following table:

Year.	Production. Lb.	Average Selling Price. Cents.	Net Earnings.
1911	22,854,000	12.03	$1,754,000
1912	24,319,000	16.19	2,766,000
1913	17,725,000	15.15	1,636,000
1914	17,200,000	13.54	1,250,000
1915*	7,836,000	13.21	715,000
	89,938,000		$8,121,000

*First quarter.

"In 1913," said Mr. Birch, "the falling off in production was due to a suspension of mining operations owing to our inability to ship ore consequent on the destruction of the tramway terminal by fire. The curtailment in 1914 was due to the European war. From early in August of the latter year practically all the copper companies of the country were closed temporarily because of conditions resulting from the war. So far as our company is concerned a cutting off of five months' production was the result."

Mr. Birch stated further, that had the company been producing from the first of the year at a similar rate to what it is now doing, its output for the first quarter of 1915 would have been much larger than is shown above. He continued:

"Our bigger production dates from May 1. We have brought in the Jumbo as a producer and as a result our output has been more than doubled. At the Beatson mine there are available unusually favorable facilities for transportation. The mines are situated near the water's edge, so that the ore is loaded on to vessels without having to be taken over a railway, consequently there are not any railway transportation costs incurred."

OIL SHALES OF NEWFOUNDLAND

By J. W. McGrath.

Now that the use of coal as a fuel is fast giving place to oil in the navies, it is most opportune to ascertain to what extent oil exists in Canada and Newfoundland. The possibility of some port in British North American waters becoming a naval base for a British North American fleet adds still more to the importance of this subject.

In recent Geological Surveys of Canada and Newfoundland, proof of the existence of extensive quantities of oil shale has been found. Mr. Harold C. E. Spence, who recently made a very close study of the oil shale fields of Newfoundland and Eastern Canada, has stated, "Having regard to the importance attaching to the obtaining of large supplies of oil fuel for the navy from sources under the British flag, and the comparatively few localities where such sources exist, it is considered of great national importance to preserve for the Empire such areas of oil shale as are found to contain sufficient volatile matter to prove workable. . . . In Newfoundland and parts of Eastern Canada some billions of tons of payable oil shales are assured and some hundreds of millions of tons are known to contain a far greater percentage of oil to the ton than the shales of the successfully operated Scotch fields. There is, therefore, a reasonable hope of a very important industry being inaugurated in the extraction and the refining of oil and by-products from these shales in the near future."

In Canada the most authentic reports would indicate that the shale bearing areas are largely confined to the eastern provinces. In New Brunswick there is no doubt as to the existence of shale fields that could be profitably worked. Several specimens of these shale deposits have been analyzed. In some cases the yield of oil to the ton has been as high as 40 gallons, whilst an average of 30 gallons to the ton has been extracted from several deposits which are commercially workable.

From Scotland a very valuable lesson might be learnt. About 1865 the scarcity of oil in Europe became problematical, for the old sources of supply were becoming exhausted. The Scots experimented with their shale deposits, which were found workable. Year after year the industry became greater by a constant enlargement in the capacity of the plant, till now the annual output of oil reaches sixty million gallons. The Admiralty have made with the companies operating in Scotland contracts in perpetuity; and yet the richness of these deposits does not in any way approach those of Canada and Newfoundland. The average yield is about 25 gallons of oil to the ton. Besides the oil, by-products are also produced. These include ammonium sulphate, paraffin wax, naptha, creosote, etc.

The shales of New Brunswick are of two distinct types. One is known as "paper shale" and appears in extremely thin formation, the other occurs in solid bodies, and almost black mass, possessing elasticity. This variety gives about 55 pounds of ammonium sulphate to the ton of shale. Some of these beds in the county are of an enormous thickness, some running up to 3000 as from eight to eleven hundred feet. The Geological Survey says: "In these Canada possesses a source of mineral wealth, the great value of which, if properly developed, can scarcely be overestimated."

In the Province of Quebec [illegible] occur. These are distinct altogether from those of Nova Scotia and New Brunswick, being of the upper Devonian area, and somewhat allied to the shale formation of Newfoundland.

The existence of bituminous formations in Newfoundland was not known till 1911. At least the extent and quality of the deposit was not known until then. A specimen of Newfoundland shale exhibited at the Festival of Empire attracted the attention of Mr. Smith Everett, an English scientist, who has specialized in shale analysis. Mr. Everett at once came to Newfoundland on behalf of the Anglo Carbon, Oil, Asphalt and Bitumen Company, and made a thorough investigation of the shale areas. The areas, according to Mr. Everett's report, were traced for thirty miles. Analyses which he made showed samples which easily produce 40 gallons of oil to the ton. The shale is impregnated with petroleum, and besides yielding the ordinary by-products common to most shales gives an allotrope of asphalt which is marked commercial demand. These deposits which is in marked commercial demand. These deposits wells. The oil wells drilled yielded to the pumps about 10 gallons of oil each day.

NATURAL GAS INDUSTRY IN THE APPALACHIAN REGION.

The market production of natural gas in the States of New York, Pennsylvania, West Virginia, Ohio and Kentucky in 1914, amounted to 425,871,728 thousand cu. ft., having a total value at the point of consumption of $73,677,641, or an average value of 17.3 cents per thousand cu. ft., according to statistics compiled under the supervision of J. D. Northrop, of the United States Geological Survey. Compared with 1913 the output of natural gas credited to these States shows a slight increase, amounting to 608,480 thousand cu. ft., less than 2-10 of one per cent., whereas, the value of the production shows a substantial gain, amounting to $4,359,537, or a six per cent. increase.

The gain in output is credited chiefly to Ohio, though New York gained slightly, the increase in these States being more than sufficient to offset the decline in Pennsylvania, West Virginia and Kentucky. The increased output of Ohio is credited chiefly to Cuyahoga County, where a gas field of considerable importance was developed in Cleveland and its suburbs as the result of discoveries made late in 1913. Unfortunately the value of the field was enormously discounted by the frenzied drilling campaign which characterized the development, and resulted in the close placing of wells with the obvious consequence of a rapid draining of the supply and a very short productive life for individual wells.

[The following poem was written especially for The New York World, by the author of "Gott Mit Uns," the [illegible] Parkway and [illegible] conditions.]

FINIS

By C. Huntington Jacobs.

Ye have not scorned to cry to us for aid;
[illegible]
When to our gracious havens, sore afraid,
Ye bore our victims from your piracies.
[illegible]
So well by such as ye is ruth repaid
To wreck with slinking death our argosies.
[illegible]

[illegible]
Your coiled water snakes, athwart our path,
[illegible]
Oh, if our spirit liveth, ye shall feel
[illegible]

GOVERNMENT PUBLICATIONS

By R. W. Coulthard.*

In that Year of Grace, 1909, there came into being, as a branch of the Geological Survey of Canada, a Topographical division. At the time (well do I remember), I, as one of many, hailed and acclaimed this departure from the hitherto staid and early Victorian policy of the Survey as a decided effort and stride toward that reformation of its future procedures for which we had long and valiantly prayed. Here at last the rumbling old chaise was being dragged out of its deep, miry and far-drawn rut of somnolent mediaevalism; hereafter it would travel the hard, smooth macadam of wakeful modernity. All hail!

Many times and oft had I looked and longed for those topographic sheets, but in vain. Well, we knew that they were in preparation and that within a few days, a few weeks at most, they would arrive in the familiar sealed packet "on His Majesty's service," but graciously intended for ours.

That, patient reader, was in the days of yore and, as I look back in retrospect through the intervening aeons of time, this looking and longing images itself before my tired gaze in composite form like unto that of a visionary, vapid and vicarious mirage. 'Tis there! Eheu! 'Tis gone!—drifted into thin air—and we stare helpless at the cerulean loveliness of an empty sky.

Up to the present, my enquiring friend, the Topographical Branch has been almost impetuous in its strenuosity. According to the Survey reports, provided I have missed none during my diligent searching, this branch has completed and mapped at least 34 (thirty-four) sheets, which are comprehensive of a range extending from the habitat of our dour Scottish blue-nosed friend to that of the exuberant "Sons of the Midnight" variety—34 completed and mapped; very creditable, beloved co-workers. But of these 34 how many have been printed, published and distributed? As far as I can manipulate the formulae provided in the Index, I have figured but 9—N-I-N-E—9 from 34, let me see, that leaves 25—25 all lying in Ottawa in a state of stagnant security. Let me enumerate:

9 published: 1, Victoria Sheet; 2, Saanich Sheet; 3, Nanaimo Sheet; 4, Sooke Sheet; 5, Prescott, Paxton Lake and Lake Mines (Texada) Sheet; 6, Deadwood Sheet; 7, White River (Yukon) Sheet; 8, Beaverdell Sheet; 9, Orillia Sheet.

25 mapped but unpublished: 1, Duncan Sheet; 2, Cowichan Sheet; 3, Alberni Sheet; 4, Slocan Sheet; 5, Flathead Coal Area Sheet; 6, Sooke Peninsula Sheet; 7, Lillooet Sheet; 8, Windermere Sheet; 9, Crow's Nest Sheet; 10, Flathead District Sheet; 11, Revelstoke Sheet; 12, Van Anda (Texada Isl.) Sheet; 13, Rainy Hollow (Yukon) Sheet; 14, Blairmore Sheet; 15, Sheep Creek (Alberta) Sheet; 16, Athabaska Sheet; 17, 18, 19, 20 and 21, 5 Lake Simcoe Sheets; 22, Thetford Sheet; 23, New Glasgow Sheet; 24, Moncton (N.B.) Sheet; 25, St. John (N.B.) Sheet.

Surely a goodly array; look—and marvel.

The distant warblings of that ubiquitous and irrepressible little bird reaches me and I glean that this self-same Topographical Branch has cost the patient, hard-working ratepayer of this fair and unfair Dominion of ours $180,000 (one hundred and eighty thousand) bright golden dollars. One of the first essentials, next to his proverbial modesty, of the engineer is succinctness, so here it is:

$$\frac{\$180,000.00}{9} = \$20,000 \text{ per}$$

I am assuming that the remaining 25 have been lost in the shuffle and turmoil of governments and things; but, indeed, should the industrious janitor or some other mighty functionary discover them from some dusty, musty and moth-infested recess by way of the old and conventional perchancing upon the hidden spring of the secret panel, they will be unearthed or unpanelled or something, and doubtless we will then be served at large and small. Some of them, it is true, will at this late date be antiquated and will exhibit woeful variance from the actual, as the arts of man will in the meantime have changed many of the featural markings of the maps; but, my goodness, they, at least, will have been printed and doled out to the long-suffering and patient. Noblesse oblige. So there you are.

We engineers in this effete but struggling West certainly appreciate to the full the importance of the Topographical Division. We are constantly calling for topographical maps. We need them in our business, so to speak, even as much as the Geological Branch of the Survey does in theirs. We remember, all of us, cursingly we remember, the inefficiencies of the old methods employed in the days of Chaucer and Rameses, those sylvan, halcyon days, when the geologist armed with pedometer and field-glass was wont to sally forth to map the ups and downs of his Mother Earth, its hills and rills, and having mapped them would place thereon the fruits of his geologic lore. And how often, tolerant reader, would we of the purely sordid school of science, in the drudgery of our daily task, find the downs where the ups should be, and the rills where the hills. Delightful, happy memories.

No, gentlemen, we now have the means, and for the sake of heaven let us get our maps, topographic and otherwise, and more of them; but let us have them when they will be useful to us. These delays are most disheartening.

Can you stand some more? A case in point; let me narrate:

Last fall, I think it was, some one of unsound mind and principle issued most remarkable statements concerning the silver hoards of the Athabaska Lake region—samples and all to prove it, mind you, and most extraordinarily of semblance like unto those of Cobalt fame, most extraordinarily—significant in fact. Upon the strength of these unhallowed remarks some scores and forties of men were lured into that inhospitable country during the winter and early spring; even the wild geese ha'n't attempted it yet. Where was I? Oh yes—early spring. Well, a geological party had spent the season of 1914 in the region north of Athabaska lake, emerging, I think, in October. The first intimation I have seen of the results gleaned from this expedition appeared in the Summary Report, which has just been let out to the undeserving public, and this is July, 1915. In my opinion, had a monograph been printed and distributed last fall the enthusiasm of the treasure seekers might have been tempered and much useless expenditure of time, money and most unprintable language been averted. But, no; that is not our system.

Other and many like instances could I recount from

*Mining Engineer, Calgary.

my vicissitudinous career in this western clime, but sufficient.

What we want, gentlemen, are monographs printed at a time when the information will be of some service, with topographical and geological maps to follow forthwith; I said forthwith.

Furthermore, and now that I am seeing red it is my privilege to run amok, what of the testing laboratories of the Bureau of Mines? We in the West are witnessing a most distressing crisis in the history of our coal mining industry. It is true that concerted action along reasonable lines, and upon the part of the operators, will alleviate this situation to a marked degree; but there is also relief to be looked for and expected in the extended and more scientific utilization of the coals. Why is not an experimental plant installed in Alberta, where it can keep in intimate touch with the industry and operator instead of in some academic background in the East, where its usefulness has been of such a practical nature that I cannot conjure up one improvement, due to it, having been developed in any western plant? They should establish themselves where the trouble is and keep hammering new ideas into those who should be interested, but who are loath to imbibe ideas which they take to be purely academical.

There are new and improved methods of utilizing the coal direct.

There are recent improved methods of gasifying coals, one of them—the Vignon catalytic method—claiming to produce from 8 to 10 times more gas than can be evolved and utilized by any ordinary retort procedure.

There are the various by-products to be garnered in from the waste of our coke ovens and coal burners of all descriptions.

There is a wide, wide field, plenty of scope, and the time is opportune; but it is here, in Alberta, that the useful field of operation lies only, and it is paramount to a crime if the department does not lend an assisting hand at a time when our coal industry is in such a condition of languishing decrepitude. Up to date about the only interest our eastern friends have taken in our western coal industries has been developed along the lines of collecting coal royalties. These have mounted up to very tidy sums, and the West now demands some returns.

MINE ACCIDENTS IN BRITISH COLUMBIA.

The quarterly statement of Coal and Metal Mine Fatalities in British Columbia for the second quarter of 1915, compiled by the Chief Inspector of Mines, shows that the number of men killed at coal mines was 23 as compared with one in the corresponding quarter of 1914, and at metal mines 6, against 2 in the same period of 1914. For the six months ended June 30, 1915, the total fatalities were 45 in and about coal mines as compared with 9 in 1914, and 8 in and about metal mines against 14 during the corresponding half year in 1914. The considerable increase in loss of life at coal mines this year is attributable to two disasters, namely, the flooding of one of the Pacific Coast Coal Mines Company's mines at South Wellington, Vancouver Island, in February, which caused the loss of 19 lives and a gas explosion at the Western Fuel Co.'s Reserve mine, near Nanaimo, V.I., in May, when 23 lives were lost. Of the remaining four fatalities that occurred at coal mines this year three were at the Cumberland mines of the Canadian Collieries (Dunsmuir), Limited, and one at the Crow's Nest Pass Coal Co.'s Coal Creek colliery, Southeast Kootenay. Of the eight deaths at metal mines this year, one occurred at the Queen mine, in Nelson mining division; two at the Consolidated Co.'s mines at Rossland; three at the Granby Co.'s mines, Boundary district; one at Nickel Plate mine, Hedley; and one at the Britannia mine, in Vancouver mining division.

WORLD'S PRODUCTION OF PETROLEUM IN 1914

The quantity of petroleum entering the markets of the world in 1914 amounted to 400,483,489 bbls. according to statistics compiled under the supervision of J. D. Northrop, of the United States Geological Survey.

Of this record-breaking output the United States is credited with 66.36 per cent., representing in quantity a trifle less than double the output of all the other oil producing countries combined.

Changes in rank during the year affected only Japan and Peru, the former superseding the latter by a narrow margin.

The following table shows the marketed production of petroleum in the world in 1914:

Country.	Production. Bbls. of 42 gals.	Per cent.
United States	265,762,535	66.36
Russia	[illegible]	16.74
Mexico	21,188,427	5.29
Roumania	12,826,579	3.20
Dutch East Indies	a12,705,208	3.17
India	b8,000,000	2.00
Galicia	[illegible]	1.26
cJapan	2,738,378	.68
Peru	1,917,802	.48
Germany	b995,764	.25
Egypt	777,038	.19
Trinidad	643,533	.16
Canada	214,800	.05
Italy	92,348	.02
Other Countries	d620,000	.16
Total	400,483,489	100.00

aIncludes British Borneo. bEstimated. cIncludes Formosa. dIncludes 600,000 bbls. produced in Argentina.

THE ELDER DAUGHTER

(Written in Canada by B. F. Griffin, in Boston News Bureau.)

Your premier sits as an equal there
[illegible]
At the Empire's call.
[illegible]
[illegible]
Your gold so free,
[illegible]
And the feather-like zeal aflame
[illegible]
And your sunlit love abroad.
[illegible]
[illegible]
Hook-reined but to see, to-day,
[illegible]
They answered nay.
[illegible]
Dunmore—give coal—coal
[illegible]
For the greater duty unfolded,
For the greater good?
[illegible]
But if scorner, sceptic, spy,
Dare doubt you are dutiful daughter still
Let Ypres reply!

BUSINESS REVIVAL ON MICHIGAN IRON RANGES

By P. B. McDonald.

After one of the dullest periods for years, the Lake Superior iron ranges are now enjoying an increase in business that is much appreciated in the mining towns scattered through northern Michigan and Minnesota. In spite of the full stock-piles seen at many of the iron mines during the first half of the season, and though handicapped by a backward beginning, it is hoped the present revival in the iron and steel trades will swell the output of ore for the season to 40,000,000 tons. This is considerably more than went down the lakes last season, but not near the record mark of over 50,000,000 tons reached in 1913.

Anticipating a better demand for ore, the Cleveland-Cliffs Iron Co., one of the largest of the "independent" producers, operating a dozen mines, mostly on the Marquette range, has raised the wages of its employees to the old standard in force previous to October, 1914. In the recent "boom" district of Iron River, on the western Menominee range, the fifteen mines operating there are employing 2,000 men, which is a great improvement over a few months ago.

Pickards, Mather & Co., operating under the name of the Verona Mining Co., is the largest employer in the Iron River district; at present it has about 300 men at its Caspian mine and is reopening its Bengal property. The Munro Iron Mining Co. is maintaining medium sized forces at its Rogers, Hiawatha and Chicagon mines; the Munro Co. is a subsidiary of the Rogers-Brown interests of Buffalo, N.Y.

The U. S. Steel Corporation's holdings at Iron River are confined to the Dobar mine, which is employing 180 men, and the McGillis development, where new buildings have been finished preparatory to the property entering the ranks of the shippers.

Wickwire Steel Co., also of Buffalo, is shipping from its new Homer mine. Corrigan, McKinney & Co. has a good sized force at the Tully mine, where an electric pump was recently installed, and may also reopen the Baker mine adjoining. The Jones & Laughlin Co. is employing about a hundred men at its Forbes mine. The Zimmerman mine, named from the late Col. Eugene Zimmerman of Ohio, one of its owners, has a force of 150 men; and Oglebay, Norton & Co.'s Chatham mine has about an equal number; as has the Davidson mine also. The James and Bates mines are going light as yet.

The Michigan State Geological Board, which each year re-values the mines of Michigan for taxation purposes, has completed its 1915 survey, and announces a total for the three Michigan iron ranges of $89,757,607, which is nearly two million less than a year ago. The reduction is mainly due to the low prices of iron ore prevailing last year, since according to the Findlay system of appraisal the worth of a mine's ore reserves is computed by using the average price of ore for the five years preceding the assessment, so that a year of low prices materially reduces the estimated present value of ore in the ground. An additional factor in the lowering of the total valuation is the gradual exhaustion of several of the famous old mines of Michigan. Thus the once-active Lake Angeline mine of Jones & Laughlin at Ishpeming has its orebodies depleted, the big Pewabic mine at Iron mountain has used up its high-grade ore and is only to be reckoned as an irregular low-grade producer—active when there is a market for low-grade ores, the steady old Hemlock mine of Pickards, Mather & Co. at Amasa is no more, and the hard ore mine at Republic, recently sold by Cambria Steel Co. to the Cleveland-Cliffs Iron Co., while still an active producer, is much reduced in proved ore reserves, and consequently in valuation. The largest single mine assessment in Michigan is the Newport mine at Ironwood, appraised at over $8,000,000. The Norrie "group" of the Steel Corporation, also on the Gogebic range, is assessed at nearly fifteen millions.

Ferdinand Schlessinger, of Milwaukee, owner of the Newport mine, returned from a European trip a few weeks ago; as his name indicates he is rather pro-German in his ideas.

The assessment of the iron mines of Michigan by counties was as follows: Gogebic, $34,572,110; Marquette, $28,616,453; Iron, $20,856,919; Dickinson, $5,906,443. The Findlay method of appraisal of mines, established in Michigan under the direction of J. R. Findlay, mining engineer, disregards a mine's equipment as of no value aside from its use to extract the orebody.

MINES INCREASING OUTPUT IN ARIZONA.

In Arizona the majority of copper mines were affected by the European war, and curtailment in output was practised by many large producers. All of the copper smelters operated at reduced capacity, and one of the plants at Clifton was closed until March, 1915.

V. C. Heikes, of the United States Geological Survey, now reports conditions improving, and all copper plants brought to full capacity, with two new smelters blown in during May. One of these, the Clarkdale smelter, will possibly eventually take the place of the old smelter at Jerome for the treatment of United Verde ores. While the new International smelter at Miami is built primarily for Inspiration mine concentrate, it is likely to be in the market for outside product. By this new addition, the copper output may be increased slightly but will probably not exceed the record figures of 1913, when 407,923,402 lb. of copper were produced.

Navigation on Yukon River was formally opened for the 1915 season on June 1st when two steamers sailed from Whitehorse for Dawson, Eagle, Ruby, Fairbanks, Iditarod, Tolovana, Nome, and other northern places. The Yukon was by that date open its full navigable length, and several boats had already reached Dawson with gold from Fairbanks. On June 5th the packet Sarah left Dawson for Nome, most of her passengers having gone from Seattle, Washington, via Skagway and Whitehorse, to Dawson in time to catch the first through boat to Nome. Hereafter a steamer will leave Whitehorse for down-river parts every other day.

——— Sergeant. "'Ere, Brown, what are you knockin' your 'orses about for?"

Brown. "Please, Sergeant, they're always 'angin' back. If it wasn't for them two bloomin' 'orses we'd 'a' bin in Berlin months ago."—Punch.

Reports from Germany say the enormous canned food industry is suffering from lack of tin.

MINERS' UNIONS IN CANADA*

The present article aims at giving in brief outline a view of the general line of policy and methods of labor organizations operating in Canada in the mining industry, so far as these may be gathered from information which has been generally accessible to inquirers. As is now well understood by those who in Canada are interested in following the course of labor organization, the conditions of this country in this matter are essentially interwoven with those of the United States by means of a system of unionism which may be described as highly internationalized. The organizations embracing different branches of the mining industry in Canada are, like other trades unions here, largely, though not exclusively, international, and it will be convenient to allow any discussion on the subject here undertaken to range not only over conditions and events in Canada, but to some extent over those also of the United States.

There are two important international bodies comprising the bulk of organized labor in the mining industry on either side of the boundary line, namely, the United Mine Workers of America, embracing workers in coal mines, and the Western Federation of Miners, embracing workers in metalliferous mines. Both these organizations are international, as stated, and have active branches in the Dominion. In Canada there is, besides, an organization not international in character, which has a considerable membership among the coal miners in Nova Scotia, and does not elsewhere exist. In the United States, so far as known, there is no organization devoted to coal mining other than the United Mine Workers of America. The Western Federation of Miners is the only organization which, so far as known, operates among metalliferous workers. It is of course possible that in the United States here and there a local union may exist including members who are working at one or other of these callings, but the union will not in such a case be one known to labor organizers generally; in the same way there are one or two purely local unions in Canada, though not so far as has been learned, any which would naturally include followers of any branch of the mining industry.

Records of both the international bodies named have been marked by turbulence to a degree hardly equaled perhaps in the case of any other organization, this condition resulting in large measure, no doubt, from the fact that the membership is composed of men of many nationalities and languages, a considerable proportion of it, moreover, particularly among the lower classes of labor, being illiterate. The rough and unpleasant character of their work has not conduced to gentle-handed methods on their part when they have been engaged in what they have believed sometimes to be a life and death struggle. An interesting illustration of the cosmopolitan nature of the union, which includes a large but fluctuating and uncertain proportion of workers in the coal mining industry, namely, the United Mine Workers of America, is the decision of the executive committee of that organization to print the official weekly journal, the United Mine Workers' Journal—in three languages, the English, Italian and Slav, representing not of course all but the predominating tongues of the workers.

It will not be possible within the limits of the article to treat exhaustively of all or any of the various phases and aspects of the work of these important labor organizations. An effort will be made, however, to indicate something of the leading phases of the scheme of organization, and some general information will be given with reference to the more important of the disputes in which they have been involved. In Canada, disputes which have arisen in the mining industry have fallen within the scope of the Industrial Disputes Investigation Act, since the enactment of that statute on March 22, 1907. In a number of cases, however, the machinery of the statute was not brought into operation until after the disputes had developed into strikes, and in some highly important instances the machinery of the statute was not utilized at all, neither the mine operators nor the employees calling for a board, and the statute not otherwise permitting the establishment of a board. Numerous investigations of considerable importance took place, however, before boards established under the terms of the Investigation Act, the employees concerned being in each case largely of one or other of the organizations named. Several investigations also have taken place in the United States, usually before commissions, the commissions having been generally appointed by the President of the United States, and having powers not far removed from those of Boards of Conciliation and Investigation established under the Canadian laws; a board or commission in either case has not had legal authority to compel the acceptance of its findings. Perhaps the most notable inquiry [illegible] the authority of the United States Government was that having to do with the great strike of the anthracite coal miners in 1902, wherein the dispute was referred to a board of arbitration appointed by the President of the United States, both parties having agreed to abide by the findings of the commission.

The organizations to be considered, therefore, are the following:

1. **The United Mine Workers of America**, an international body with a total membership exclusively among [illegible] at the year 1914 at 328,473, including a membership on the Canadian side of the boundary estimated at 14,8[illegible].

2. **The Western Federation of Miners**, an international organization confined to workers in metalliferous mines, with a total membership [illegible] of 1914 at 23,000, including the Canadian membership estimated at 4,015.

3. **The Provincial Workmen's Association of Canada**, a body with a membership confined to coal miners in the Province of Nova Scotia, and estimated at the end of 1914 at [illegible].

It may be noted that for a number of years there has been a movement on foot or being carried by [illegible] among the international unions covering coal and metalliferous miners. But organizations [illegible] favorable to the plan of consolidation, the consummation of which would make an organization of approximately 600,000 members, the largest single body of organized labor in the world. The relations between the U. M. W. A. and W. F. M. have not always been friendly. In 1914 the United Mine Workers discontinued the interchange of cards with the Western Federation on account of the severe criticisms of the policy of the then president of the U. M. W. A., Mr. John Mitchell, by The Miners' Magazine, published by the federation, and of

*Extract from the Forty-Ninth Annual Report of the Department of Labor, Ottawa.

President Moyer, of the W. F. M. Of late years, however, the two organizations have been on more amicable terms, and the interchange of transfer cards has been re-arranged. The three organizations will be considered separately.

United Mine Workers of America.

Previous to the advent of the United Mine Workers of America several attempts had been made to organize unions of mine workers, but each effort to found a permanent organization met with failure. As early as 1849 a union of mine workers was formed in the anthracite coal region of the United States by an Englishman named John Bates, but this body was short-lived, as were several other unions of a local character.

In 1861 an organization called the American Miners' Association was established in Illinois, and gradually extended its operations to the Eastern States, but the association, owing to a number of unsuccessful strikes in 1867 and 1868, collapsed in the latter year. In 1869 a union known as the Miners' and Laborers' Benevolent Association was organized in the anthracite coal fields. This organization grew rapidly and maintained an existence until 1875. In this year a general strike was inaugurated which closed nearly all the mines in the region, but, owing to the opposition of the mine owners and to internal dissensions of a varying nature, the strike failed, and the organization was destroyed.

During the period in which the Miners' and Laborers' Benevolent Association was operating in the anthracite region the Miners' National Association was thriving in the bituminous coal fields of the United States. In the year 1874 its membership exceeded 20,000, but the union shortly went to pieces.

Following the dissolution of these organizations the Knights of Labor came on the scene, and for a time its growth was rapid in both the anthracite and bituminous regions. The influence of the Knights of Labor, however, began to wane with a diminishing membership and, by 1885, the power of the organization had passed. In that year the Miners' National Progressive Union was formed, and was apparently more successful in the bituminous coal fields than any of its predecessors, trade agreements with the operators having been established in a number of localities. Constant friction with what remained of the Knights of Labor organization hampered the influence of the union, and by 1890 its membership had dwindled to such a degree that it became apparent that in order to maintain a successful organization of the mine workers it would be necessary to secure the consolidation of the remnants of the Miners' National Progressive Union and Assembly No. 135 of the Knights of Labor, which claimed jurisdiction over the men employed in the coal mines. On January 25, 1890, this amalgamation was effected, forming what is now known as the International Union United Mine Workers of America. Almost from the inception of this new body it became affiliated with the American Federation of Labor.

The objects of the United Mine Workers of America are set forth as follows in the constitution effective April 1, 1914:

"First—To unite in one organization, regardless of creed, color or nationality, all workmen eligible for membership, employed in and around coal mines, coal washers and coke ovens on the American continent.

"Second—To increase the wages, and improve the conditions of employment of our members by legislation, conciliation, joint agreements, or strikes.

"Third—To demand that not more than eight hours from bank to bank in each twenty-four hours shall be worked by members of our organization.

"Fourth—To strive for a minimum wage scale for all members of our craft.

"Fifth—To provide for the education of our children by lawfully prohibiting their employment until they have at least reached sixteen years of age.

"Sixth—To secure equitable statutory old-age pension and workmen's compensation laws.

"Seventh—To enforce existing just laws and to secure the repeal of those which are unjust.

"Eighth—To secure, by legislative enactment, laws protecting the limbs, lives and health of our members; establishing our right to organize; prohibiting the use of deception to secure strike breakers; preventing the employment of privately armed guards during labor disputes; and such other legislation as will be beneficial to the members of our craft."

Scheme of Organization.—It will be of interest to examine some of the more important features of the constitution of the U. M. W. A., involving its scheme of organization and the powers vested in the various officers and branches of the union.

The organization, which is essentially industrial in character, including in its membership all craftsmen who are employed in and around coal mines, is administered through a system of districts, sub-districts and local branches, all of which must be chartered by the international union. The officers of the international union consist of president, vice-president, secretary-treasurer, three tellers, three auditors, the delegates to the American Federation of Labor, an international executive board consisting of one member from each of the districts over which the U. M. W. A. has jurisdiction, together with the president, vice-president and secretary-treasurer. All elective officers, with the exception of the executive board members, are elected biennially by referendum vote of the whole membership; executive board members are elected by the votes of the members in their respective districts.

Among the duties of the president is that of appointing a member to collect and compile statistics on the production, distribution and consumption of coal and coke, freight rates, market conditions and any other matter which may be of benefit to the organization. The president may also appoint organizers and other officials, including traveling auditors, to examine the accounts of the local branches, such officers to be agreed upon by the districts and international union, who jointly bear the expense; he may also grant district or territorial dispensations relating to initiation fees, when in his judgment such dispensations will add to the growth of or conserve the interests of the organization. The calling of special international conventions is vested in the president, when so instructed by the International Executive Board, or upon the request of five or more district unions. The salary of the president is $4,000 per annum and expenses.

The vice-president works under the instructions of the president and the International Executive Board, and in the event of the presidency being vacated by resignation or otherwise, the vice-president succeeds to the position. For his services he receives $3,300 per annum and expenses.

The secretary-treasurer, who is bonded to the extent of $25,000, in addition to receiving and disbursing the funds of the organization, is required to submit to all local branches a semi-annual statement, and to per-

form such other duties as may be assigned by the president or international executive board. The salary is $3,300 and expenses. The president, vice-president and secretary-treasurer are required to render reports of their stewardship at each biennial convention.

The International Executive Board, which is convened on order of the president, or by the secretary-treasurer at the request of a majority of the members thereof, is required to execute the instructions of international conventions, and between conventions has the power to direct the affairs of the organization. The board may levy and collect assessments, but no such assessment shall be for a longer period than two months, unless authorized by a referendum vote. Money deposited by the secretary-treasurer in the name of the Executive Board can only be drawn upon the order of two-thirds of the members of the board. The Executive Board has power between conventions and, by a two-third vote, to recommend the calling of a general strike, but under no circumstances may such a strike be called until approved by a referendum vote. When a roll call vote is demanded on any question before the Executive Board, each member is entitled to one vote and one additional vote for each 2,000 members in good standing which he may represent. Where a unit vote only is taken, the three resident members at Indianapolis, the headquarters of the organization, are entitled to vote. The president has the casting vote where the roll call vote results in a tie. When the board is not in session the individual members are subject to the direction of the president. The salary of an Executive Board member is at the rate of $125 per month when employed.

The regular conventions are held biennially on the third Tuesday in January, representatives to be elected directly from the local branches they represent, and to be entitled to one vote for one hundred members or less, with an additional vote for each hundred members with a maximum of five votes. Local branches organized one year prior to the date of holding a convention, and having one hundred members or more in good standing, must be represented in the convention or pay a fine of $25 for each one hundred members in good standing, unless exonerated by the International Executive Board. Exception to this rule is allowed where the members of a local have been idle for one month or more prior to the convention on account of strikes, suspensions or closing of mines. Local branches with less than one hundred members may combine with similar locals within a reasonable radius in the same district and elect delegates to represent them, but no delegates so elected shall be entitled to more than five votes. No local branch if in arrears for per capita tax or assessments is entitled to representation at a convention. New local branches are not entitled to representation unless organized three months prior to a convention, except where such branches are composed of members of old branches in good standing at the time the new one was organized. Delegates must be members employed in or around a coal mine, coal washer or coke oven or in the employ of the organization, and regular attendants of the meetings of the local. Members occupying positions other than as mine workers, except with the U. M. W. or an affiliated organization, are not eligible as delegates. The international organization pays for the transportation of delegates to and from the conventions on a basis of one delegate from ten to two hundred members and one additional delegate for each additional five hundred members or fraction thereof, provided such fraction is not less than twenty-five members. The revenue of the international organization is derived from charter fees, a per capita tax of 25c. per month, with such additional assessments as may be levied by an international convention, referendum vote, or as may be authorized by the International Executive Board.

District unions are composed of the local branches in the territory allotted, and have power to adopt such laws for their government as do not conflict with the laws of the international union or joint agreements. Sub-districts may be formed with the same rights and privileges as are enjoyed by district unions. The local branches comprising the district are under the control of the district union. The officers of a district union, who are elected by referendum vote, consist of one president, one vice-president, one secretary-treasurer and a board of five members, the whole constituting an Executive Board. This Board meets every three months, but special meetings may be called. District unions have the power to collect per capita tax and to levy and collect assessments from its own members when necessary, but such assessments must not exceed $1 per member per month. The district officials are compensated in such manner as the district union decides, the conventions of which are held annually.

Membership Qualifications, Initiations, Fees, Dues.—The laws governing local unions provide that local branches shall be composed of ten or more workmen, skilled or unskilled, working in or around coal mines, coal washers, or coke ovens, each local branch having jurisdiction over one mine. Mine managers, top foreman, operators' commissioners, persons engaged in the sale of intoxicating liquors, and members of the Civic Federation or Boy Scout movement are declared not eligible for membership.

The international constitution provides that, unless a dispensation has been granted by the president, the initiation fee for practical miners is $10, the fee for inexperienced miners and top and bottom men is subject to the laws of the respective districts. The initiation fee for members' sons between fourteen and seventeen years of age is $2.50. Members wishing to attend school as pupils are granted leave of absence, and on returning to the mines are admitted to membership without any further payment of initiation fee. Members working in non-union mines, unless with the consent of the president or the district concerned, forfeit their membership, as do also members becoming three months in arrears for dues and assessments, unless officially excused. The payment of dues may be transferred to monthly terms. The local dues must not be less than 50 cents per month, one half of which goes to the international organization, with such additional assessments as may be levied in accordance with the constitution. Boys under sixteen years of age, and decrepit or disabled members are required to pay only half of the tax or assessment levied. Local branches may be exempted from the payment of dues and assessments under certain conditions, provided the members have been idle for one month and the request for exemption approved from month to month. Local branches are prohibited from granting aid in strikes unless such strikes have been endorsed by the American Federation of Labor or an affiliated body. Other laws for the governance of local branches and their officers are also included in the constitution, among which is a provision that check weighmen must be members of the

U. M. W. for at least six months previous to election, except in the case of newly-organized branches.

The organization has in operation a transfer card system whereby members may transfer from one locality to another and still maintain a continuous membership with the union. Transfer cards issued by the Western Federation of Miners, the International Mining Congress and miners' unions of Australia and New Zealand are accepted by the organization, subject to the same provisions governing the acceptance of U. M. W. cards. Transfer cards of the Provincial Workmen's Association, however, are not accepted.

Regulations as to Strikes.—On the subject of strikes, the constitution provides that no district shall be permitted to engage in a strike involving all or a major portion of its members without the sanction of an international convention or the International Executive Board. District unions may order local strikes within their respective districts, on their own responsibility, but where such strikes are to be financed by the international union, they must be sanctioned by the International Executive Board. Strikes may be called in unorganized coal fields, provided the sanction of an international convention or of the International Executive Board has been granted, but unless otherwise decided by the International Executive, no financial aid is to be furnished by the international union for the support of any strike until after the strike has been in effect four weeks. This same board also shall decide the conditions upon which strikes may be financed by the international union, and determine the amount of relief to be paid to each member involved, etc. When strikes are sanctioned and financed by the international union the international president may appoint, subject to the approval of the International Executive Board, a financial agent who shall assume responsibility for all international funds so expended, said agent to be bonded to an amount to be determined by the International Executive Board, and no bills are to be paid by the international union unless contracted or authorized by said agent, the resident international officers or the International Executive Board. The accounts of the financial agent may be audited every quarter, or more frequently if considered necessary. When strikes are financed by the international union, each local branch involved in such strikes is required to furnish weekly details of all expenditures, under penalty of being debarred from financial relief from the international union.

Early Difficulties.—For several years after its establishment in 1890 the United Mine Workers Union gradually extended its influence and enrolled a considerable membership in both the anthracite and bituminous coal fields of the United States. In 1894, after a general strike, only partially successful, the membership of the union rapidly declined, until in the spring of 1897 there were less than 9,000 members, with practically nothing of the union left in the anthracite field. About this time the bituminous miners called a general strike, which, after a stubborn contest, resulted in a compromise settlement. The result of this agreement, though only giving the miners a slight advance, apparently gave an impetus to the organization, and the membership rapidly increased in the bituminous coal districts. On April 1, 1898, the U. M. W. A. secured, by agreement, the eight-hour day in the central competitive coal field, and later established the principle in all its well-organized sections. Not much progress was being made in these days in the anthracite regions, and U. M. W. A. organizers, early in 1900, renewed their efforts to awaken interest on behalf of the organization, with, however, only a limited degree of success. Owing to failure to secure certain concessions from the operators, a strike of the anthracite miners was called on September 17, 1900, and although the membership of the union at this time was less than 8,000, between 80,000 and 100,000 took part in the strike on the first day. This number was gradually augmented during the next two weeks until there were nearly 144,000 employees idle. Work was resumed on October 29, the strikers having secured a number of concessions, including a 10 per cent. increase; recognition of the organization, however, was not granted. A little later, nearly every man and boy employed in the anthracite coal districts became a member of the United Mine Workers of America.

The Anthracite Coal Strike of 1902.—On May 15, 1902, again a strike was declared by a convention of delegates called to consider the matter. The dispute, which was believed to be on a larger scale than any previous strike in the United States, involved the anthracite districts, and included 150,000 employees, union and non-union.

The occasion of the strike was the demand of the United Mine Workers for an increase in wages, a decrease in working hours, and payment for coal by weight wherever practicable, and where then paid by the car. The union also demanded recognition. Much disorder and lawlessness, including three fatalities, occurred during the strike. The houses of men who remained at work were dynamited in several cases, and the lives of women and children were jeopardized. Officers of the Mine Workers publicly condemned violence and exhorted their followers to maintain law and order. The services of the state militia were, however, necessary to preserve the peace. Meanwhile, efforts at settlement were made by many public-spirited men. The union offered to submit the matters in dispute to arbitration, but the operators refused.

All attempts to bring the contending parties together having proved futile, United States President Roosevelt, on October 3, 1902, invited the various railroad presidents, the president of the anthracite district unions, and Mr. John Mitchell, the president of the U. M. W., to meet him. President Roosevelt appealed to the meeting to sink personal considerations and to make individual sacrifices for the common good. The president of the U. M. W. proposed that all the matters in dispute be submitted to the arbitration of a tribunal to be selected by the President. This proposition did not meet with the approval of the operators, who denounced the union, and urged the President to station federal troops in the anthracite coal fields. A few days after this conference, the entire National Guard of Pennsylvania was ordered to the coal fields by the Governor of the state. The operators had stated that with military protection they would be able to supply sufficient coal to meet the necessities of the public, but the presence of the troops had no appreciable effect upon the output. On October 13, 1902, a representative of the operators called on President Roosevelt and offered to submit the dispute to a commission of five men to be appointed by the President. Objection was raised by the Mine Workers' president to a stipulation that the arbitrators should be selected from certain classes of society, and he urged that the United States President should be given full power to select the members of the com-

mission. This was finally agreed to, and on October 23 work was resumed. The strike had lasted five months and a half. During the sixteen last weeks of the strike the sum of $2,645,000 was collected and disbursed in aid of the strikers and their families.

The award of the Anthracite Coal Strike Commission was rendered on March 18, 1903. The employees did not get all their demands, but secured substantial increases in wages and material improvement in working conditions, also recognition of their organization. An important feature of the award was the provision for a board of conciliation to which disagreements under the award were to be referred for adjudication. The award was to continue in effect until April 1, 1906.

Suspension of Work in Anthracite and Bituminous Fields.—Although the agreement indicated above had still, in July, 1905, many months to run, yet negotiations were then opened with the coal operators with the view of making a new agreement on the termination of the award of 1903. The miners demanded an increase of 12½ per cent. over the then existing scale, as well as other concessions, including check-off and eight-hour day, the contract to continue for one year from April 1, 1906. The operators refused the demands and offered to renew the working agreement drafted by the Anthracite Coal Strike Commission of 1903. On April 1, no agreements having been reached, the bituminous miners to the number of 384,000 went on strike, while 150,000 in the anthracite coal fields suspended operations, not admitting that they were actually on strike. Many non-union miners were included among those who ceased work. Conferences followed between miners' officials and operators included in the joint interstate convention representing the central competitive and the southwestern competitive coal fields. The demands of the miners were finally modified, and it was proposed to accept a scale on the basis of the rates paid in 1903, plus an advance of 3 cents a ton in the southwestern states. Concurrently with negotiations in the bituminous fields, conferences and correspondence were being conducted with the anthracite operators. Being unable to secure the 12½ per cent. increase in the anthracite mines, the miners asked for a restoration of the 5½ cent reduction which was agreed to in 1901 owing to depression in trade. This was also refused. On May 18, 1906, the miners' convention decided to renew for three years the award of the Anthracite Coal Strike Commission, and, save here and there, work was soon afterwards resumed in both anthracite and bituminous regions.

In 1906 the interstate joint convention composed of miners and operators, which had been in operation for a number of years as a means of adjusting wage scales, was dissolved, owing to the failure of the board to arrange a satisfactory wage scale upon the termination of the contracts which had expired in that year.

In 1908, at the Indianapolis convention, Mr. John Mitchell, who had been president for nine years of the United Mine Workers Association, retired from that position, and was succeeded by Mr. T. L. Lewis, who had been for some time vice-president.

Compromise in Bituminous Field. On March 31, 1908, a number of contracts expired in the central competitive bituminous field. The Scale Committee of the United Mine Workers prepared a report which was submitted to a special convention of the miners and was adopted. No renewed working agreement was secured before the expiry of the existing contract, and on April 1, 200,000 men ceased work. On May 1, work was resumed under an agreement reached on April 17 between the operators and the men. The contract was to continue in force for two years, and provided for a wage of 90 cents a ton, an eight-hour day and the reference of disputes to districts for settlement.

Agreement in the Anthracite Regions.—Previous to the expiry of the anthracite miners' agreement in 1909, conferences were held by the miners of districts Nos. 1, 7 and 9 and the operators. As a result, an agreement was reached, the same to become effective April 1, 1909, and to continue for three years—until March 31, 1912. The contract specified: (1) that the rates to be paid for new work should not be less than the rates paid under the award of the Anthracite Coal Strike Commission of 1903 for old work of a similar kind; (2) that the decision of the Conciliation Board permitting the collection of dues on company property and the posting of union notices should be continued; (3) that an employee discharged for being a member of a union should have a right to appeal to the Conciliation Board for final adjustment; (4) that disputes arising at a colliery working under the agreement should be first taken up with the foreman and superintendent in charge, and in case of failure to settle, should be referred to the Conciliation Board; (5) that the employers should issue pay statements showing the names of employees, amount of wages and class of work performed.

Compromise in the Bituminous Districts.—On expiry, on March 31, 1910, of the agreements in the bituminous districts covered by the interstate joint convention, the miners and operators were unable to agree on renewal contracts. The miners asked an increase of 10 cents a ton, as well as the betterment of working conditions, the contract to run for two years. The terms were not acceptable to the operators, who made counter proposals which were not considered favorable by the miners. A suspension of operations on April 1, 1910, occurred in the districts concerned, involving 300,000 men. Agreements, however, were soon negotiated, and operations were resumed.

New Agreements in the Bituminous and Anthracite Regions.—On March 31, 1912, the agreements in the bituminous and anthracite regions covered by the interstate joint convention expired. New agreements had been reached with the bituminous operators. These contracts, which were to continue in force for two years, dated March 31, 1914, provided for varying increases in the wage scale in the different districts of the bituminous fields, as well as other concessions to the miners.

In the anthracite fields, however, no new contract had been reached and there was a suspension of work by approximately 150,000 employees. Conferences followed, the negotiations lasting for about twenty days, when an agreement was finally reached. The new contract, which was to be effective until March 31, 1916, provided: (1) for a 10 per cent. advance in wages; (2) publishing of colliery rates; (3) recognition of mine committees; (4) proper election of check weighmen, and other minor matters, including practically recognition of the union.

Strike in Colorado. On April 1, 1910, a strike began in the coal fields of southern Colorado. The dispute arose over a demand for an advance in wages on expiry of the previous contract. On March 5, 1912, nearly two years from the commencement of the

strike, one company operating eight mines with 3,000 employees effected a settlement by granting an increase of 3 cents a ton on run-of-mine coal and 5 per cent. on day work. The strike at the other mines in the district continued, with no apparent prospect of settlement. In January, 1913, a committee of the Lower House of the Colorado State Legislature investigated the strike situation. In its report to the Legislature the committee stated that the strike was justified, and that the demands of the strikers were reasonable. The committee also reported that its efforts to effect a settlement of the dispute had been assisted by the union officials, but that the operators had blocked all attempts in that direction.

The U. M. W. proceeded meantime with the work of organizing the miners throughout the state, and on September 23, 1913, a strike affecting 11,000 employees was called at the mines in southern Colorado. The demands of the miners included recognition of the union, 10 per cent. advance in wages, and other reforms in working conditions. A number of the smaller independent operators signed the agreement, and operations were resumed. In the districts where the strike continued, rioting occurred at intervals, and in some instances continued for several days, many miners and mine guards being killed and injured. State troops were sent to quell the disturbance, and strikers were arrested for picketing and also on charges arising out of the strike. The miners and their families took shelter in tents which had been provided by the union. On October 21, 1913, a Congressional investigation was commenced. On November 22, a proposition by Governor Ammons for a joint conference of operators and their striking employees was accepted by both parties, but the conference failed to bring about a settlement. Governor Ammons and the Federal Secretary of Labor, Mr. Wilson, urged that the matters in dispute be referred to arbitration, but the suggestion was refused by the operators, and later the U. M. W. officials were indicted for conspiracy in restraint of interstate commerce. On December 18 the Colorado Federation of Labor passed resolutions demanding the release of imprisoned miners, the withdrawal of the militia, and the recall of the Governor for what was claimed to be a failure to do his duty. On March 15, 1914, the tents of the strikers were torn down and more strikers were imprisoned. The strikers appealed to the President of the United States and to the Secretary of Labor and a number of congressmen for Federal intervention. On April 14 the state militia were withdrawn, and on April 28 federal troops were ordered to the strike district. With the coming of the federal troops peace was restored, the strikers and mine guards being disarmed by order of the Secretary of War. The President was later urged to compel the mine owners to accept mediation of the strike. In addition to a federal investigation, it was stated that no less than thirty committees had investigated the strike, but none of these had been able to bring about any settlement. The miners, however, secured contracts with some of the independent operators.

In August, 1914, an order was issued by the Secretary of War prohibiting the importation of strike-breakers who were not citizens of the state of Colorado. On September 8 the President of the United States proposed terms of peace, or rather, as it was termed, a truce, to continue for three years. The proposition was based on the report of the conciliators appointed by the Secretary of Labor, and provided: (1) enforcement of the mining and labor laws of the state; (2) re-employment of strikers who had not been guilty of violations of the law; (3) prohibited the intimidation of union or non-union men; (4) current scale of wages, rules, etc., for each mine to be posted; (5) grievance committee for each mine to be selected by majority ballot of employees (except officials of company). It was further suggested that grievances be first taken up individually with the proper officer of the company; failing adjustment, the grievance to be referred to a local grievance committee. Still failing adjustment, the matter in dispute was to be submitted to a commission composed of three men to be appointed by the President of the United States, representative of each side, with the third member as an umpire. Other conditions covering the proposed terms of settlement were the waiving of the claim for contractual relations; prohibition of employment of mine guards; withdrawal of troops; no picketing, parading or mass campaigning of miners; no suspension of work during consideration of grievances. All decisions of the commission were to be final. The expense of the commission was to be borne equally by the parties in interest. The miners called a special convention of the district to consider the proposal, and on September 15 the proposition was accepted. The operators, however, refused to accept the peace proposition, unless certain modifications were made.

At the thirty-fourth annual convention of the American Federation of Labor, held in Philadelphia, Pa., in November, 1914, a resolution was adopted calling on the President of the United States to insist that the coal operators immediately comply with the federal plan of settlement, and in the event of refusal that the President take the necessary steps to have a receiver appointed for the purpose of taking over the mines and operating them in the interest of the people under federal supervision. In the month of December, 1914, the Colorado situation was under consideration by the Federal Commission on Industrial Relations. On December 10, 1914, the representative of the miners, by a unanimous vote, called off the strike, depending, as it was stated, on the promise of the President that the commission appointed by him would compel the enforcement of the laws of the state, the abrogation of which by the operators, it was alleged, was the immediate cause of the strike.

Membership.—The story told in the foregoing pages by a recital of the strikes of the organization is a long and sad one, in many respects a tragic one. It is under such circumstances that the union has made its way from a membership of less than ten thousand in 1897 to over three hundred thousand in 1914. Whether for good or ill, the organization has made itself a power to be reckoned with.

In addition to the paid-up membership there are many members who, for various reasons, have not paid, some from inability. These are known as exonerated members. Including paid-up and exonerated members, the complete membership of the organization is much larger, standing, at the close of 1912 at 386,966, and in 1913, at 415,142. There are in all 2,574 local branches and twenty-six district unions.

During the past fourteen years no less a sum than $12,175,607.76 has been expended by the union in strike benefits.

Advent into Canada.—According to records available, it appears that the first local branch of the U.

M. W. organized in Canada was No. 2314, which was formed in Fernie, B.C., on May 15, 1902. This local union was originally organized in April, 1899, as Gladstone Miners' Union of the Western Federation of Miners, but changed its affiliation and became identified with U. M. W. on the first mentioned date. Michel local of the federation also changed its affiliation and became a local branch of the U. M. W. in June, 1903. On November 9, 1903, District Union No. 18 was formed, the jurisdiction including the coal fields of the mainland of British Columbia and the province of Alberta. The first local branch organized in the latter province was No. 431, which was formed in Bellevue on December 13, 1903. Other local branches were formed in the district from time to time, the number at the close of the year 1914 being twenty-one.

For a number of years the operations of the U. M. W. in Canada were confined to the territory included in the jurisdiction of District No. 18, but in December, 1908, extended its activities into Nova Scotia, local branch No. 469 being established in Springhill. In the following year a large number of branches were formed in the Cape Breton coal fields, four of which are still in existence. District Union No. 26, with jurisdiction covering the province of Nova Scotia, was also instituted early in 1909. The district at the close of the present year was composed of six branches.

During 1911 several local branches were formed in the coal fields of Vancouver island in the province of British Columbia, and in December, 1911, District Union No. 28 was established with jurisdiction over the territory named. The branches connected with this district at present number six.

U. M. W. Strikes in Canada.—The first strike in the coal mining industry of Canada under the auspices of the United Mine Workers of America was that beginning on March 9, 1906, at Lethbridge, Alta., involving 500 men in the employ of the Alberta Railway and Irrigation Company. The demands of the strikers embraced: (1) recognition of the union; (2) check-off system, by which the dues, assessments, etc., payable to the union were to be deducted by the company from the employees' wages; (3) a minimum rate of pay to miners of $3 per shift; (4) an eight-hour day for underground day work; (5) a material increase in the wages for underground and outside day labor; (6) rate of $5 per day for miners taken from contract to do company work; (7) coal mined by contract to be weighed before being screened; (8) the hearing of grievances by the company's officials and a pit committee, and other minor demands. The strike continued for many months, and in November the Deputy Minister of Labor visited the locality in the capacity of conciliator. The parties to the dispute were brought together and a compromise settlement effected by which most of the men secured an increase of 10 per cent. and a number of other concessions. The strike was declared off on December 3, 1906. The company did not give recognition to the union, but promised that members of the union should not be discriminated against.

On April 1, 1907, the agreement between the several companies comprising the Western Coal Operators' Association terminated. A conference held at Calgary for the purpose of effecting a new contract proved ineffective, and the employers, numbering 3,450 of the companies concerned, suspended work. Some days later applications were made by both parties to the dispute for a board of conciliation and investigation under the provisions of the Industrial Disputes Investigation Act, which had become law only on March 22, 1907, and a board was constituted. The operators and the miners carried on direct negotiations, looking to an adjustment of the matters in dispute, the board assisting, and on May 2 a settlement proposition was submitted to a referendum vote of the miners. The agreement, which was to continue for two years, was accepted, and on May 7 work in the mines was resumed. The agreement as adopted granted varying increases in wages, and provided for a permanent board composed of representatives of both parties, before which disputes may be brought for final settlement.

On the expiration of the above agreement on March 31, 1909, the preliminary conference between the Western Coal Operators' Association and the officials of the U. M. W. having again proved ineffective, a strike of 2,500 employees occurred on April 28, 1909. One large company which had been in 1907 in the Western Coal Operators' Association had made a separate agreement, and was for the time outside the association. The differences existing were later referred to a board of conciliation and investigation under the Industrial Disputes Investigation Act, and a settlement was ultimately effected on June 30, based on the old agreement, to be effective till March 31, 1911.

On June 23, 1909, the officers of District Union No. 26 sent communications to the coal operators in Nova Scotia requesting them to attend a joint conference in Sydney on July 2. This communication, and a later one to the same effect, appear to have been ignored by the operators. In April a board of conciliation and investigation was, on demand of the employees (represented by the U. M. W. A.) of the Dominion Coal Company at Glace Bay, appointed under the provisions of the Industrial Disputes Investigation Act to investigate various grievances, chiefly an alleged discrimination against workmen because of their membership in the U. M. W. The board found that there had been no improper discrimination. The union had also demanded union recognition. The board failed to secure any working agreement, and on July 6 a strike of 2,500 men, members of the U. M. W., was declared at Glace Bay, arising mainly, as it appeared, from the refusal of the Dominion Coal Company to recognize the union. In this dispute the U. M. W. came into conflict with the Provincial Workmen's Association, an organization of miners which had operated in the coal fields of Nova Scotia for many years previous to the entry of the U. M. W. into the district, and with which only the company had entered into agreement, terminating December 31, 1909. Members of the Provincial Workmen's Association remained at work. On July 7 some disturbances occurred as the non-strikers proceeded to work, and troops were sent into the locality to preserve order. Some intimidation took place, families were evicted from the company's houses, and some arrests were made, several on charges arising out of disturbances. The strike was declared off on April 28, 1910. The union does not appear to have secured any concessions.

On July 9, 1909, the members of the local lodge of the U. M. W. at Inverness went on strike for recognition of the union, and demanded the recognition of the Provincial Workmen's Association by the mining company who had an existing agreement with the latter organization. This strike occurred without having the dispute go before a board. Some disturbances having

occurred the day after the strike, the officials of the coal company asked for military protection, and a number of troops were sent to the locality. The strike continued for some months, but became gradually ineffective and was apparently never declared off formally.

On August 9, 1909, a strike of 1,700 miners occurred at Springhill. The demands of the men included the recognition of the U. M. W. and better conditions relating to employment. Before the strike was ordered the demands of the men were considered by a board of conciliation and investigation under the Industrial Disputes Investigation Act. The findings of the board were not acceptable to the union, and the strike resulted. The strike was declared off on May 27, 1911, without, as it appeared at the time, any special concession to the union.

Reports of the U. M. W. A. showed that the organization spent during the year 1910 the sum of $968,775 in strike benefits in District No. 26, comprising the coal fields of Nova Scotia.

Turning again to Western Canada, we find that on April 1, 1911, owing to the failure once more of the conference between the Western Coal Operators and the officers of District 18 of the U. M. W. A., the employees, numbering 6,000 of sixteen coal companies ceased work. The question of making a new agreement was subsequently referred to a board of conciliation and investigation under the Industrial Investigation Act. The award of the board was not, however, accepted, and the strike continued. A basis of settlement was finally reached, providing for a 10 per cent. increase in wages, and for a number of changes in conditions of employment. The new contract was to continue in force until March 31, 1915. Work was resumed on November 20, 1911.

On September 16, 1912, miners at the Canadian Collieries at Cumberland, Vancouver Island, among whom a local of the U. M. W. had sprung up, ceased work as a protest against an alleged discrimination by the company against two of their number. Two days later the mine workers employed by the same company at Extension mines, near Nanaimo, B.C., also quit work. The strike continued until May 1, 1913, though becoming somewhat ineffective. On May 1, 1913, a strike was declared at all the coal mines on Vancouver Island, and approximately 3,000 men ceased work. The mines at Cumberland were perhaps the least affected by the new strike. The demands of the miners included an advance in wages and recognition of the union. During August, 1913, some rioting occurred in the strike district, and the militia were sent to keep order. Many strikers were arrested and convicted for complicity in the disturbances. The strike was the subject of a special investigation under a Royal Commission of the Dominion Government. The Minister of Labor and the Deputy Minister were also at different times on the ground, but no settlement could be secured. The strike benefits are said to have been at the highest rate ever paid by the union, $16,500 being distributed weekly for many months. During the year 1913 the benefits disbursed amounted to $584,500; for the first six months of 1914, $432,000, making in all over $1,000,000. The strike was declared off on Aug. 19, 1914, it was not clear on what basis, but the outbreak of the great European war no doubt had an intimate bearing on the situation.

The foregoing does not include all of the disputes with which the Canadian membership has been involved. There were a number of minor controversies, some of which were settled without much difficulty. In some important disputes the issues were referred to boards of conciliation and investigation formed under the provisions of the Industrial Disputes Investigation Act, the union securing sometimes material concessions.

(To be Continued.)

GOLD IN NOVA SCOTIA

By J. A. MacDonald.

The gold in Nova Scotia occurs chiefly in quartz veins, some of which cross the strike of the formation, but most of which are interstratified with the rocks and lie chiefly in slate beds found in the quartzite formation. The veins are found on the domes and at the plunging of the anticlines, and the outcrops form a series of concentric elipses or portions of elipses. While most of the veins are interstratified they are often seen to cross the slate bed and pass from the foot wall of quartz to the hanging wall. Veins are frequently corrugated. The gold occurs in shoots which pitch at a low angle to the east or west. Most of the gold is free milling. The richest portions of the veins seem to lie in those parts of the domes where there is some irregularity in the rock structure. It is evident that the deposition of the ore is dependent on the rock structure.

Gold has been mined in about fifty different centres in Nova Scotia, but systematic prospecting, assisted by the work of the geological surveys, may yet reveal the presence of other paying centres.

Laying out mining claims in Nova Scotia.—All gold or silver properties in Nova Scotia are to be laid out in areas of two hundred and fifty feet in length, magnetic, meridian, north and south, and one hundred and fifty feet, east and west. Areas are required by the regulations to be laid out as far as possible uniformly, and in rectangular shapes. Surface measurements of areas must be horizontal, and each area must be bounded by vertical planes passing through the horizontal surface lines.

Every person who stakes off land in Nova Scotia not less in extent than six areas, upon which he has discovered gold or silver, is entitled to a license or lease of the areas included within such land, provided he has made application for a license or lease of the same within one week after staking off, and 24 hours' additional time for every 15 miles distant from the office of the deputy commissioner. A prospecting license shall be in force for 12 months from the date of application therefor. Surveys of land comprising the areas held under lease may be ordered by the Commissioner.

There is also provision for the issuing of what is known as an Alluvial License, good for three months only, between March 31st and December 1st only, of any one year. An alluvial license means a license to search for gold-bearing earth or rock elsewhere than *in situ*. The holder of an alluvial license is empowered to proespect over a territory comprising five hundred (500) acres, which territory may be greater in length than twice the width; but shall not be less than 750 feet in width.

Before a prospecting or alluvial license is issued the applicant must enter into a bond to compensate the owner of the land, in the event of private land, and also pay the royalties, which for gold and silver is two per centum of the gross value thereof.

ZINC LOSS IN PRECIPITATION

The paper read by Mr. Dorfman, superintendent of the McIntyre mill, before the Porcupine branch of the Canadian Mining Institute aroused much discussion and was of importance to all millmen. It was specially prepared for the Northern Miner by Mr. Dorfman.

Mr. Dorfman writes: A certain amount of trouble in cyanide mills arises in the precipitation system. Very little attention compared with the other branches of cyanidation is paid to this phase of the question. While we find elaborate descriptions in technical literature of almost all existing gold mills we do not get any details of the precipitation question. We all know and all have had unfortunate experiences when the precipitates were being dissolved from the press, of something that seems against chemical laws. In such a case the mill man usually blames the canvas for leakage, the sampler for accuracy, or the assayer for incorrect assay. His usual remedies are the addition of lead acetate, higher cyanide and alkiline contents or vice versa, till finally things get somewhat straightened out and he is only too glad to forget his troubles and does not care to go back and find out the real causes of such abnormal facts.

The problem of precipitation must be definitely solved in its details and studied. Systematic work will have to be done. First of all what becomes of the zinc going to the presses or going out from the presses and also what are precipitates?

The following experiment was carried out at the McIntyre mill for seven days, all the mill solutions were carefully sampled for this period, and the zinc and precipitates were carefully weighed. American zinc dust was used, which contains 95.04 per cent. total zinc. The amount of zinc used up for the week was 984 lb., yielding 935.19 lb. of zinc. In cleaning out the precipitation press the dried precipitate was found to weigh 735 lb. The zinc content of the precipitate was 3.25 per cent., giving 239.38 lb. of zinc left in the presses, consequently 695.81 lb. of zinc was dissolved from the presses. In other words 74.4 per cent. of the total zinc is wasted by secondary reactions.

The first impression, at least the visual impression, is always that there is almost as much zinc in the presses as there was put in. The results of the experiment appear to be rather amazing. But the solution assays give the following results: the pregnant solution analyzed 0.108 lb. of zinc per ton, while the barren solution showed 0.308 lb. per ton, or an increase of 0.15 lb. for each ton of solution. As 4,703 tons of solution was precipitated, the amount of zinc from the presses would be 705 lb., or 75.4 per cent. of the total zinc in solution was wasted in secondary reaction.

For seven days the clean-up gave 832.31 oz. of fine gold and 17.39 lb. of silver. The theoretical amount of zinc to precipitate the total silver would be 6.178 lb. In practice the amount of zinc used to keep up precipitation was almost 1,000 lb.

How do the solutions get rid of the zinc?

All the mill solutions were sampled and showed the following zinc contents:

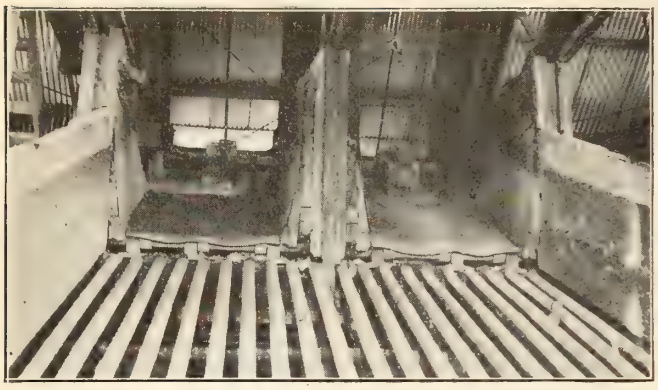
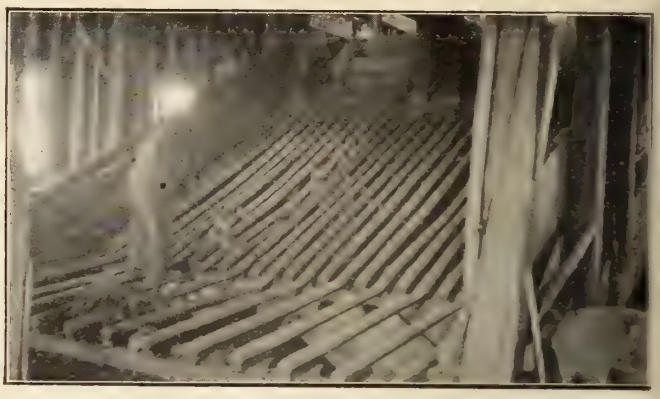
	Zinc per ton of Solution
Hardinge mill discharge	0.157
Storage	0.213
Classifier overflow solution	0.147
Agitator solutions	0.147
Pregnant solutions	0.158
Barren solutions	0.308
Tail solutions	0.125

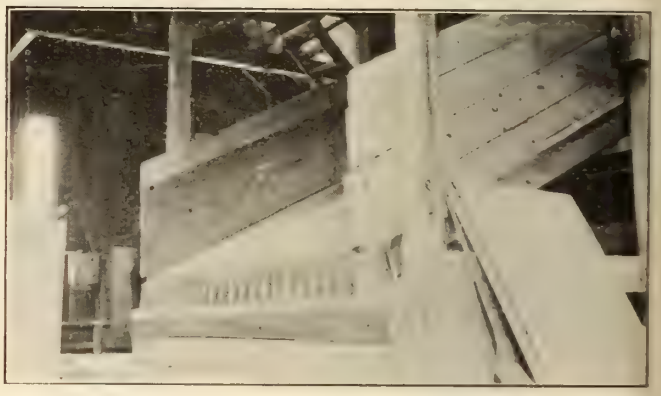
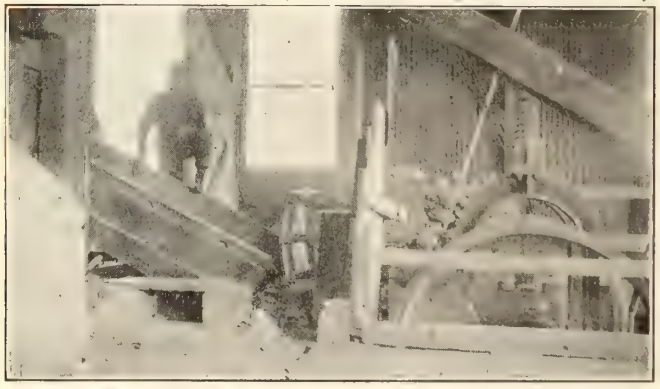
The report of the experiment showed the amount of zinc precipitated out from the solutions at each stage.

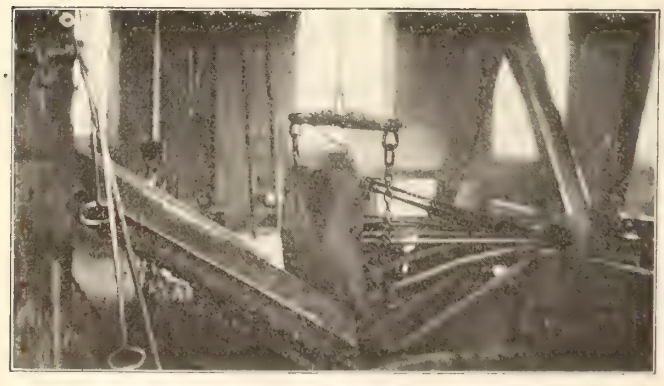
	Zinc Precipitated	Percentage of Zinc used in press
Hardinge mill	150.96	16.14
Tube mill circuits	179.96	19.24
Agitators	90.23	9.65
Decantation system	281.93	30.15

It will be seen that if we add the amount of zinc precipitated in each of these stages we get a total waste of 705.08 lb. or 75.18 per cent. of zinc.

A gold quartz vein, Dome mine, Porcupine



Some Rock-house suggestions from the Michigan Copper Country

Some Rock-house suggestions from the Michigan Copper Country

TOUGH-OAKES GOLD MINES

In the Companies (Winding-up) and Chancery Division on July 15 Mr. Justice Neville had before him the petition of Mr. G. F. S. Bowles, of Connaught square W., for the compulsory winding up of Tough-Oakes Gold Mines, Ltd. Mr. Peterson, K.C., and Mr. Manning were for petitioner; Mr. Clauson, K.C., and Mr. Macaskie for respondent company.

Mr. Peterson, K.C., said this was a petition by a shareholder to wind up Tough-Oakes Gold Mines, Ltd., and the question in substance before the Court was whether or not the substratum of the company had disappeared. There were two Tough-Oakes Gold Mines Companies, one a Canadian, and the other an English Company. The Court had now to deal with the English company, which was formed to acquire from the Kirkland Lake Proprietary, Ltd., a controlling interest in the Tough-Oakes Gold Mines, Ltd., of Haileybury, Ontario. The English company had an authorized capital of £500,000, in £1 shares, of which 230,007 were allotted and called up, including 30,000 shares issued as fully paid. The three directors were: Mr. G. R. Bonnard, Mr. F. Johnson and Mr. R. Simpson. The English company issued a prospectus dated 9th March, 1914, offering 100,000 shares for subscription at par. The prospectus stated that the company had been formed to acquire from Kirkland Lake Proprietary, Ltd., of 4 and 6, Throgmorton avenue, E.C., the promoter of the company, (a) 426,388 fully-paid shares in the Tough-Oakes Gold Mines, Ltd., of Haileybury, Ontario, a Canadian company with a capital of $3,000,000, divided into 600,000 shares of $5 each, owning the Tough-Oakes Gold Mine, in the Kirkland Lake Goldfield, Ontario, and (b) options of purchasing in part or in whole a further 171,110 shares in the Canadian company. That, said counsel, was the basis of the company. The English Tough-Oakes Company had received £200,000 cash in respect of shares issued by it. The company had paid to the Kirkland Lake Company for the 66,781 shares which had been delivered to it £44,996 15s. 3d., which left a balance in its hands of £155,003 4s. 9d. There was a peculiar transaction by which the English company was to take up for £30,253 8s. shares in the Kirkland Lake Company. These were apparently bought from the Union and Rhodesian Trust, Ltd., which acted as secretary of both companies. This left a balance of £124,749 16s. 9d. Now, what happened to the rest of it? In the same building (Finsbury Pavement House), and on the same floor, were a number of companies, in all of which Mr. H. G. Latilla had an interest, and the names of all these companies appeared on the door. Of the balance of £124,749 no less than £112,831 12s. 9d. was advanced by the English Tough-Oakes Gold Mines to the various companies and individuals in this building. This appeared to have been a regular in-and-out business, each company having shares in the other, and giving as security for loans shares in its company. After these loans had been made there was left £11,918 4s. These advances were made right up to well into August of last year, and the result was that it was quite impossible now to get this money back from these companies. The war had intervened and made matters on the Stock Exchange more difficult than before. The result was that this English company had not got the money necessary to carry out the agreement with the Canadian company, and the substratum of the company was therefore gone. The companies and individuals interested in the loans were the Tough-Oakes Gold Mines, Ltd., Finsbury Pavement House, formerly 4-6 Throgmorton avenue, the Union and Rhodesian Trust, Ltd., the Anglo-Transvaal Rhodesian Trust, Sudbury Syndicate, Ltd., Kirkland Lake Proprietary, H. G. Latilla, Secretariat, Ltd., and the Ptarmigan Mines, all the addresses being the same The directors of the Tough-Oakes were Bonnard, Johnson and Simpson, and loans wer made to the other companies. Latilla and Burt were directors of the Union and Rhodesian Trust, and there was a loan made to them of £60,612 3s. 7d., the security being 14,800 shares in Kirkland Lake Proprietary and 2,945 shares in Sudbury Syndicate. Burt and J. D. G. Simpson were directors of the Anglo-Transvaal Rhodesian Trust. The loan was £5,500 and the security 2,000 shares in Ptarmigan Mines and 8,000 shares in the Union and Rhodesian Trust. The director of the Sudbury Syndicate was Burt, the loan was £500, and the security 500 shares in Kirkland Lake Proprietary. In Kirkland Lake Proprietary Latilla, Burt and J. D. G. Simpson were the directors, the loan was £29,062, and there was no security. The share capital pledged was 18,013 shares, including 2,000 ex Bonnard, 1,500 R. Simpson and Bonnard, 820 R. Simpson, 1,475 R. and J. D. G. Simpson, 1,065 A. Burt, 225 H. Warwick, and 350 V. W. Comer. There was a loan to Latilla of £6,389, the security being 5,200 shares in the Union and Rhodesian Trust. The Secretariat, Ltd., had as directors F. Johnson and Latilla (formerly R. Simpson). The directors of Ptarmigan Mines were F. Johnson and Latilla, and the share capital pledged was 2,000 shares, all ex Latilla and Burt.

Mr. Clauson, K.C., said before the war the shares given as security for the loans were being dealt in on the Stock Exchange at figures which justified the loans. Of course, now all these figures had gone to pieces.

Mr. Owen Thompson said he represented holders of 155,000 shares opposing the petition.

Mr. Luxmore, for 20,542 shareholders, supported the petition.

Mr. Clauson said his clients, the company, had tried to get the Kirkland Lake Proprietary to carry out the contract. Mr. Foster was the man who was causing all the difficulties, and he (counsel) alleged that this was an action to prevent the company bringing its actions against Foster and Latilla.

Counsel said his point was very simple. If these holders of 20,000 shares wanted satisfaction their first step should have been to put the company into voluntary liquidation. There were three actions pending in the King's Bench Division, and it might be that when they were finished the substratum of the company would be gone, but they should wait until they had finished their actions.

Mr. Peterson said the question was really could this company carry out its contract? Where was its money? The whole of it was loaned to this congeries of companies, and even when they were sued they could not pay. How was this English company to pay for these shares in the Canadian company? The shareholders' position was that, owing to the malpractices on the part of the directors it was no longer possible to complete the contract. The company had not the money to carry out the contract.

His Lordship: Has Mr Bonnard got any description except as "a director of companies?"

Mr. Peterson: I don't know of any.

His Lordship: Do you know anything of Johnson?

Mr. Peterson: His business was acquired by Secretariat, Ltd., Latilla being the other director. Counsel argued that most of the directors of the companies involved were members of the "nest" at Finsbury Pavement House.

Mr. Clauson said there were less than 24,000 shares involved in this petition, and he asked was it just and equitable that a winding-up order should be made when there were at least 155,000 shares against? The Court must have regard to the wishes of the contributories, and he had the large majority. There were actions pending in another branch of the Courts to compel the completion of the contract, and this petition should stand over pending the hearing of those actions.

His Lordship directed the petition to stand over pending the hearing of the actions in the King's Bench Division, the company undertaking to prosecute the actions in the King's Bench Division with due diligence and to use its best endeavors to get in any moneys owing to the company.—Financial Times, London.

PREVENTING AND LIMITING EXPLOSIONS IN COAL MINES.

The U. S. Bureau of Mines has just issued Technical Paper 84, "Methods of Preventing and Limiting Explosions in Coal Mines," by George S. Rice, chief mining engineer, and L. M. Jones, mining engineer.

Mr. Rice in the introduction says: "Although advance in the knowledge of mine explosions, particularly coal dust explosions, has been slow, yet since investigations were begun in 1908 by the testing stations of various countries, progress has been steady, each station contributing to the general fund of knowledge.

"During the fiscal year ended June 30, 1914, the U. S. Bureau of Mines had an especially fruitful period of investigation, available funds being sufficient to carry on an important series of large scale explosion tests at the experimental mine at Bruceton, Pa., in order to determine the relative explosibility of different mine dusts and the efficiency of various methods of preventing and of stopping explosions. The large scale testing for relative inflammability was supplemented by inflammability tests in the laboratory. In all, the explosion experiments were undoubtedly the most important and instructive of their kind ever conducted in this country.

"During the year the work was greatly stimulated by a month's visit of J. Taffanel, the distinguished director of the French testing station at Lievin, who collaborated with the bureau's representatives at the experimental mine in making standardizing tests that would permit the comparison of the more important results with those obtained in the French testing gallery, and also with the results of the small group of experiments made in the Commentry mine, France. The tests were designed mainly primarily to determine (1) whether the same percentages as ash and other inert matter in the dust mixtures for a similar class of coal would prevent ignition of the dust from a blown-out shot and (2) whether a strong explosion of gas or dust would be propagated throughout a long adjacent zone containing such mixed dust.

"While Mr. Taffanel was present certain barrier devices that had proved effectual in the French gallery were tested to ascertain whether they would prove effectual under American mine conditions, and also to compare their efficiency with barrier devices, devised by the bureau. Although the French devices proved effective, the bureau's seemed better suited to the usual American mine conditions.

"Much information was obtained from the tests conducted during the year in determining the velocity of propagation of explosions, the pressure obtained at certain stages with different mixtures, and the gases produced. At the time of preparing this publication the data are being compiled, but compilation and correlation of the large mass of data will take considerable time. Therefore, it has been considered expedient to publish promptly a brief report of such practical results as may be applied to the prevention and stopping of explosions. Especially it is hoped that the suggestions may lead operators of dusty bituminous mines to take additional safeguards during the winter and early spring, because it has been demonstrated that there is especial danger of coal dust explosions during and following cold weather, owing to the natural drying out of coal dust in the mines. Of course, it must be fully understood that precautions must not be neglected at any time in the year; the issuance of methane into the mines is not affected by seasonal changes, and in extensive mines, if watering of some sort is not practised, dry dust is frequently found in abundance in the interior of the mine, even in warm, humid weather. The final proof of a safe condition where watering or humidifying is employed is to have the dust wet in every part of the mine, and at all times of the year."

STEEL CO. OF CANADA.

The Steel Company of Canada is increasing its open hearth steel capacity to take care of the large war orders it has taken from England direct and from the Canadian Car & Foundry Co. The company has 14 plants making bolts, wire, etc., and is also turning out steel for shrapnel and shells. It is working at full capacity and turning out steel at the rate of 900,000 tons per year. At the present basis of steel prices the company should have the best year in its history in 1915.

MINES AND HUMANITY.

If war is becoming less humane, mining is becoming more and more humanitarian.

The late Dr. Holmes of the Bureau of Mines, Washington, rounded out a life devoted to long years to safer and more rational conditions for mine labor. The policy of this bureau has been to co-operate with state [illegible] the industry had acquired [illegible] influence. The result was rapid progress not only in safety but also in living conditions.

In the Connellsville coke region, which employs 18,000 employees and their families at its mines, [illegible] has adopted every safety device possible, affords relief in case of temporary or permanent disability and [illegible] faithful employees who become incapacitated. Every mine has its fire fighting organization and first-aid stations, and the company has 200 first-aid [illegible] available. These employees pay no contributions and receive relief payments without [illegible] proceedings. In a few years over half a million dollars has been spent in bettering the condition of workmen in sanitary and other similar matters. More than 1,000 shade trees have been planted, and miners vie in competition for the best gardens and lawns. The sight of children playing on the 20 play grounds is a thing that may well cause the old heart to feel young again.—The Wall Street Journal.

PERSONAL AND GENERAL

Mr. H. L. Roscoe, of the British-American Nickel Company's staff, formerly instructor in metallurgy at the Michigan College of Mines, has joined the staff of the Quincy Mining Company, Hancock, Mich.

Mr. R. G. McConnell, Deputy Minister of Mines of Canada, is in Vancouver.

Mr. E. C. Pullen, superintendent of the Alexo nickel mine, is taking an officers' training course at Niagara camp.

Mr. J. Parke Channing is at Houghton, Mich.

Dr. F. W. McNair is on a trip to Denver, Salt Lake City, and San Francisco.

Dr. William Battle Phillips, director of the Bureau of Economic Geology and Technology of the University of Texas, has been appointed president of the Colorado School of Mines.

Mr. W. F. McNeil is arranging a mineral exhibit for the National Exposition at Toronto.

Mr. F. M. Connell is at Goodfish Lake.

Mr. Robert Flaherty is again en route to Hudson's Bay. This year he travels via Cochrane and the Moose river. His last year's trip was around the Labrador coast.

Mr. Charles Lawton, general manager of the Quincy Mining Company, has been visiting silver mines at Cobalt.

Mr. Albert Blair is at San Pedro, Coahuila, Mexico.

Mr. Raoul Madero is at Torreon, Mexico.

Mr. M. C. H. Little of Cobalt, is examining the St. Anthony gold mine, Sturgeon lake district, Ontario.

Mr. J. G. Sipprell is at Renfrew, Ont.

Dr. A. C. Lane is at Houghton, Mich.

Mr. D. A. Thomas has visited the Nova Scotia plants engaged in the manufacture of munitions.

Mr. Roy Reynolds has been appointed captain at at Trimountain mine.

GERMANY'S COPPER.

The Boston News Bureau publishes the following comment on a recent German despatch:

If all the war reports emanating from Berlin are as accurate as that under Berlin date of July 31, from the Overseas News Agency and relating to Germany's supply of copper, some big discounts are in order. The report in question is to the effect that the German Government has begun a systematic gathering of figures and statistics concerning existing supplies of copper, it having "been known previously that in addition to the increase in copper production, the supplies surpassed 2,000,000 tons, sufficient to meet war requirements for ten years." Reduced to pounds we are asked to believe that Germany has reserve supplies of 4,480,000,000 lb. of copper, which amount is more than double her own production plus imports from the United States for the past ten years.

If one wants the figures covering the past ten years, here they are (in lb.): Germany's production, 450,000,000; Germany's imports from United States, 1,600,000,000. Here is a total of 2,050,000,000 lb. of copper, or less than half the stock now claimed. If the Berlin report were even 50 per cent. true it would mean that Germany had on hand to-day available for war purposes her total production and American imports for the past ten years—a story too absurd to warrant dignified denial.

THE REVEILLE OF ROMANCE.

Regret no more the age of arms.
Nor sigh "Romance is dead."
Out of life's dull and dreary maze
Romance has raised her head.

Now at her golden clarion call
The sword salutes the sun;
The bayonet glitters from its sheath
To deck the deadly gun;

The tramp of horse is heard afar
And down the Autumn wind,
The shrapnel shrieks of sudden doom
To which brave eyes are blind.

From East and West and South and North
The hosts are crowding still;
The long rails hum as troop-trains come
By valley, plain and hill;

And whence came yearly argosies
Laden with silks and corn.
Vast fleets of countless armed men
O'er the broad seas are borne.

All come to that gay festival
Of rifle, lance and sword,
Where toasts are pledged in red heart's blood
And Death sits at the board.

Now Briton, Gaul and Slav and Serb
Clash with the Goth and Hun
Upon grim fields where whoso yields
Romance, at least, has won.

Though warriors fall like frosted leaves
Before November winds,
They only lose what all must lose
But find what none else finds.

Their bodies lie beside the way.
In trench, by barricade,
Discarded by the titan Will
That shatters what is made.

Poor empty sheaths, they mark the course
Of spirits bold as young;
Whatever checked that fiery charge
As dust to dust was flung.

For terrible it is to slay
And bitter to be slain.
But joy it is to crown the soul
In its heroic reign.

And better far to make or mar.
Godlike, but for a day,
Than pace the sluggard's slavish round
In life-long, mean decay.

* * * * * *

Who sighs, then, for the Golden Age
Romance has raised her head.
And in the sad and sombre days
Walks proudly o'er your head.

—Lt. Peregrine Acland.

48th Highlanders, 15th Batt.

SPECIAL CORRESPONDENCE

BRITISH COLUMBIA

While information relative to the part miners in British Columbia are taking in connection with further participation in the European war is far from complete, it is known that many of them are doing their full share. Numbers of men from various parts of the Kootenay and Boundary mining districts are among the soldiers in training in the camp near Vernon, Okanagan, preparing to follow others who volunteered for service early in the war and proceeded to England and thence to the battle front. At the present time coal miners on Vancouver Island are organizing themselves into companies for active service. The liberal response being made by miners in various parts of the province to appeals for funds for the purchase of machine guns is creditable and gratifying. Men in the employ of the Canadian Collieries (Dunsmuir), Limited, at Ladysmith and Extension, have undertaken to contribute $1,000 for a gun; at Hedley, Similkameen, employees of the Hedley Gold Mining Co. at the Nickel Plate mine have contributed the money for one gun; others employed at the same company's gold mill have done similarly, while the townspeople and others resident near Hedley have promised still another. There are other instances of help being rendered in this way, but these are mentioned by way of illustration of the fact that the miners are contributing freely in both men and money to the Empire's present need. Still another instance occurs to mind—Mr. Wm. Fernie, in the early nineties of last century a pioneer in the development of the coal resources of the Crow's Nest Pass country, but now spending the evening of his earthly life in Victoria, lately gave $1,000 for a machine gun for the use of Kootenay soldiers now in camp.

West Kootenay.

Ainsworth.—Concentrating ore from the Silver Hoard mine, near the town of Ainsworth, has been sent to the Consolidated Mining and Smelting Co.'s concentrating plant at Rossland for test purposes. Spokane men have done much development work on the Silver Hoard property and have opened a considerable quantity of ore that will require concentration, so they are endeavoring to ascertain what treatment process will be best for this ore.

Other Spokane men have opened the Florence mine, situated two or three miles from Ainsworth, and it is claimed there is much ore available. Extraction whenever it shall be deemed advisable to make the mine a regular producer. Still other men from Spokane are making investigations concerning some mineral claims in the neighborhood of the Bluebell mine, across the lake from Ainsworth.

Slocan.—Among the mining news published recently by the Slocan Record, New Denver, are the following notes: It is stated that so far the Standard Silver-Lead Mining Co., which in July resumed shipment to Trail of silver-lead ore and concentrate from its mine and concentrating mill near Silverton, Slocan lake, has not been supplied with more than 12 railway cars a week by the Canadian Pacific Railway, notwithstanding that twice that number could easily be loaded and sent out. However, this matter will be righted in a few weeks. The ore shoot opened lately in the Wakefield mine, above Four-mile creek, has been found to widen out to about 2 ft. Fifteen tons of ore have already been sacked; a carload shipment will shortly be made. (Note—This mine, formerly a profitable producer, had been idle for a number of years until last spring, when some local men arranged with the owners to work it.) A strong vein of high grade ore was opened last week on the Black Grouse mineral claim, situated about two and a half miles from Three Forks, on the North Fork of Carpenter creek; it was encountered in a crosscut adit 210 ft. from the portal and at a vertical depth below the surface of about 200 ft. The ore shoot is between 3 and 4 ft. in width.

On July 17, the Spokesman-Review, of Spokane, Washington, in which city reside several directors of the Rambler-Cariboo Mines, Ltd., published the following statement relative to the Rambler-Cariboo mine, which is situated a few miles from Three Forks. The increase in the price of spelter since the last consignment of twelve cars of zinc concentrate was forwarded to the smeltery at Bartlesville, Oklahoma, U.S.A., before expiry of its contract with the Rambler-Cariboo Company, has resulted in the settlements for that shipment running $15,000 over the estimate, with two cars yet to be settled for, according to reports received yesterday by the company. Settlement was made yesterday for the last two of ten cars of the concentrate that had been treated, and the draft received was for $8,256, or approximately $103 a ton net. The two remaining cars will probably bring settlement at a similar rate, which will make the increase on the entire consignment about $20,000 higher than the estimate. The Rambler-Cariboo company is now negotiating with several zinc ore buyers for a new smelting contract, and it is thought probable that shipment of zinc concentrate will be resumed about August 1. Reports from the Rambler-Cariboo mine state that there is about $30,000 worth of zinc concentrate in store ready for shipment, and that consignments of silver-lead concentrate are being sent regularly to the Consolidated Company's smeltery at Trail. The belief is growing stronger among stockholders in the Rambler-Cariboo Company that the directors will in August or September authorize payment of a dividend. If so, this will be the first dividend to be paid by the company for about fifteen years.

From other sources it has been ascertained that several mines that had been idle for some years are once again to be worked, among them the Lucky Jim situated in the neighborhood of Cody, which property was the first in the Slocan district to begin to ship. Mortgagees resident in England are advertising inviting tenders for the Monitor and Ajax [illegible] at Three Forks, a concentrating mill and equipment near Rosebery, Slocan lake, and the Boom group lying between New Denver and Silverton. The Monitor and the Boom were producing ores during the early flourishing times of mining in Slocan district, but were closed when conditions became unfavorable following the great set-back of the United States market to lead ores from British Columbia. These and several other English-owned mining properties in the Slocan are expected to again become producing mines now that conditions are favorable to a resumption of work on them.

Boundary.

From Grand Forks has come news of more attention being paid to mining properties in North Fork of Kettle River district. The Gazette states that negotiations are under way for bonding the Gloucester group of mineral claims in Franklin camp to the Granby Consolidated Co., and it is expected that the transaction will shortly be arranged. The Gloucester group includes five claims, on which considerable development work has been done, both by shaft and adit. Some good ore has been opened; the value is principally in copper, the gold content being but small. The group adjoins the Union property, from which several hundred tons of ore, averaging $80 a ton, has been shipped. Early in July, Mr. C. M. Campbell, superintendent of the Granby Consolidated Co.'s big copper mines at Phoenix, examined and sampled the Gloucester property, and it is stated that ore from a 50 ft. shaft gave excellent assay returns in copper. It is expected the Granby Co. will shortly do development work on the Gloucester. Many owners of mineral claims situated in Franklin camp hope that much good will result from the Granby Co. again turning its attention to that part of the district, in which there are known to be some promising mineral showings.

Atlin.

A few weeks ago another "fairy tale" given publicity in Vancouver was to the effect that a prospector had found a $40,000 lump of gold "lying loose on the hanging wall of a quartz vein," and some comment was added to the news, which was alleged to have "come along the Government telegraph line to Vancouver," as follows: "To date Australia has held the banner with the 'Welcome Stranger' and 'Welcome' nuggets, but must now sit back for the 'daddy' of them all." Eventually the story was whittled down to a statement that Mrs. Alexander, wife of Captain Alexander, who owns the Engineer claim, had found "a pocket of nuggets on the surface of the vein." It seems consequently that it was not the "$40,000 lump of gold" that was "lying."

Other Atlin news, which does not look like fiction, comes from Seattle, as follows: The year 1914 saw a very successful clean-up on the Atlin creeks. The year 1915 promises better, and if no further discoveries are made for 50 years the creeks have in sight material for active work for that period from properties already located. But there is a stampede now to Wilson creek, and there is no saying what may be in the future for the unprospected districts all around. Sam Fitzgerald has returned from the coast and expects to install a hydraulic plant on his placer property this season. Clarence Achison, son of E. W. Achison, of Skagway, is ground-sluicing on his claim on Rose creek, with promising prospects. The O'Donnell River Partnership Company is again sluicing, and the outlook for a good clean-up is more favorable than that of any previous year. Mr. Davis, of the McKee Creek Co., arrived by the first trip of the "Gleaner," accompanied by two Pittsburg financiers who are looking for investments. J. M. Ruffner, operating in Blue canyon, has his hydraulicking pipe all laid, has turned on a good sluice-head of water, and is now actively engaged in mining. Spruce creek will make a big showing this year, as many new operators have started work with first-class outfits and are now beginning to locate good pay. Mr. Matthews, who has valuable ground on Spruce creek, has shut down on account of lack of dump ground, as the creek claim owners are working this season. Mr. Meyers, who owns valuable placer property on Rose creek, just above Blue canyon, arrived on the last steamer and is taking in with him two men to open his ground. The North Columbia Gold Mining Co. had a very satisfactory clean-up recently. James Tallmire has purchased an auto truck to be used in hauling freight and passengers. Louis Shultz has also received a passenger car and will shortly purchase a truck for freighting purposes. The McKee Creek Mining Co. expects to have a good season, as it has already had two clean-ups with very gratifying results. The company's new dam is almost completed; when finished it will hold sufficient water to run its plant for some time.

NEW YORK

The widespread improvement in the iron and steel trades over the country has been the talk of the fortnight, presaging as it invariably does general industrial prosperity. Iron ore mining is increasing at Lake Superior, and even in the Alabama districts where conditions have been unusually dull.

The extraordinary output of copper, particularly in Michigan, has tended to depress the price of the metal, pending further large buying orders.

Zinc ore concentrates in the Joplin, Missouri, district are selling at from $80 to $100, depending on the grade, a decline from a few weeks ago, following a similar decline in spelter prices. The strike of the miners in this district died a natural death; commonsense reasserted itself. Production is brisk.

Talk of the United States going to war is now hampering financial sentiment scarcely at all. Efforts by hysteria-mongers to scare somebody have fizzled out.

Although the bituminous coal trade is improving but slowly, the port of Hampton Roads, Virginia, is exporting record amounts, principally to the West Indies and Latin-America.

In 1914, the United States produced two-thirds of the world's petroleum, or 265,762,000 bbls. out of a total of slightly over 400,000,000 bbls. Next in quantity was Russia, which produced about one-sixth of the world's total. Mexico and Roumania rank next with 5.29 per cent. and 3.20 per cent. productions respectively.

In view of the importance of petroleum products for war uses, it is interesting to note that the combined outputs of Roumania, Dutch East Indies, Galicia, and Germany, which is the extreme limit of what Germany could possibly muster for herself, are less than 8 per cent. of the world's production, a total of less than 32,000,000 bbls., of which Germany's own contribution is less than a million bbls. The disposition of the production of the Dutch East Indies, in 1914 (including British Borneo) about 12,700,000 bbls., is problematical, as it is by no means likely that the different conflicting elements of the situation permitted Germany to acquire more than a fraction of this amount.

The United States Government is reported to have bought 500,000 oz. of silver on August 6, and will buy a like amount on August 13.

There is more interest being taken in Porcupine mines than for some time, due to the better outlook at the Dome, to confidence in Captain De Lamar's presidency of Dome, to Hollinger's excellent record, and to the several favorable minor developments at other properties.

Britain is importing petroleum at double the normal rate. Three-quarters of it is coming from the United States and one-quarter from the Far East and Mexico.

NEWFOUNDLAND

The output from the iron mines owned by the Dominion Iron and Steel Company and the Nova Scotia Company respectively continue weekly to increase. For weeks past the output of ore from these mines reached a total of 70,000 tons, which is much greater than the output at ordinary times. The Dominion Company's operations, however, are much more brisk than those of the Nova Scotia Company. The Dominion is now working a stock pile for exportation which had not been touched for a period of more than two years.

Practically all the ore exported by the Dominion Company is consigned to the smelters at Sydney. The Nova Scotia Steel Company will ship little if any ore to the United States this year as it formerly did. A larger market, we understand, than usual, has been secured in Great Britain. Middlesbro in former years was the principal receiving port; but this year the ore will be sent to several ports. Owing to the high freights prevailing the profits on ore may not be so satisfactory as formerly.

Gangs of men are being taken on by these companies regularly and in a few days a record output is expected to take place. It is understood that sufficient orders have been placed with the companies to keep operations going up to the close of navigation.

The mine at Tilt Cove, the property of the Cape Copper Company, which had been worked at intervals for over sixty years, but which of late years had been left inoperative, is now working on a fairly large scale again, and we understand as time goes on work there will become more brisk. Already a few cargoes of copper have been shipped from the mine since opening up this season.

Another copper mine, located in the district of Harbour, has just been opened up. Apparatus and equipment have lately been installed and gangs of men are now working there. The ore is said to be of high grade and in a short while more extensive operations are expected to be begun.

By what is considered very sharp work a very valuable copper claim was recently secured by some local parties. The claim had been held for years, and this year negotiations were being conducted prior to its opening up or a sale. The claim, by accident, over lapsed for a day or two, and before it could be retaken by the original parties they found themselves ousted completely by another party. The action in question drew condemnation from most of the local press.

A new company, the Newfoundland Products Corporation, which expects very soon to start the erection of a large plant at Bay of Island will require for consumption in its factories 657 tons of phosphate rock or 239,805 tons yearly; 219,000 tons of coal per year as well as 40 tons of iron pyrites. None of these minerals and mineral ores exist in workable quantities in Newfoundland, and hence they must needs be imported.

Some activity is being manifested by those interested in mines, etc., for the acquisition of slate quarries. It is thought that these quarries will be secured with a view to the necessity that is bound to be felt in Europe for slate used in roofing purposes after the war.

In Newfoundland there are several slate quarries which contain slate of an excellent quality. Some of these quarries have been worked with very good results. In view of the comparative proximity of Newfoundland to Europe it is not improbable that an industry of this nature might be developed.

PORCUPINE, KIRKLAND LAKE, SESEKINIKA AND MUNROE TOWNSHIP

The progress of the Porcupine camp during the past six months is more marked than for any previous year of the gold camp's existence. It is very largely due to the phenomenal development of the new ore body at the Dome mines. This orebody has now been developed for three levels of 100 ft. each; the average width of the orebody is 100 ft. The known length is 330 ft. This is a distinct orebody, separate from the Dome and what was known as the Gold Stairway vein. Very little of this ore has as yet been stoped, but an increasing amount of it will be available as development is continued. The shaft has been carried down to the 800 ft. level, but it is not proposed to cut a station before 850 ft. as levels are being opened up only at intervals of 150 ft. The lowest developed level at present is the 6th or 550 ft. A station has been cut at the 700 ft. level, and ore is already being developed there. The huge crusher has been lowered down the mine to the 6th level. As this crusher is the biggest crusher being used for this kind of work underground, the work of lowering it down the mine was delicate and required considerable time. It should be installed and doing work in a month or six weeks. The production of the Dome for the month of July was $131,000 in bullion recovered; tonnage showed considerable increase, amounting to 28,300 tons for the period. The average mill heads ran nearly $5.00, of which $4.62 per ton was recovered. In order to give the ore coming from the new orebody a longer treatment the cyanide tanks in the mill have been raised. There is a considerable amount of coarse gold in the new orebody, and to enable the management to get a good extraction it was found necessary to make this change.

Although the Dome Lake Mining Company is still working from hand to mouth the development for the past two months has been far more encouraging. On the 400 ft. level the second ore shoot has been developed for about 40 ft. It is running very satisfactorily; an average grade of $18 to $20 being recovered across 3 ft. The second stock pile is now being treated in the mill; two-thirds of the ore treated comes from the dump, one-third from development at the 400-ft. level, from the winze at the 180 ft. level and from the A shaft. The A shaft is developing very satisfactorily. The vein at 64 ft. dipped into the wall, but a few shots showed that it was fully as high grade as in the shaft. It will be followed down on an incline. The clean-ups from the mill for the past three months have been running about $10,000 in bullion and $500 in concentrates. Owing to the non-delivery of a car of coal it was found necessary for some time to discontinue the use of the tube mill, as two-thirds of the saving was made in the tube mill previously. The ore is now being run through a 20-mesh screen before the stamps.

Progress is now being made to carry the winze on the Vipond below the 430 ft. level, at which it was halted. Development is being continued on the vein on the 400 ft. level with fair results. The winze will be carried down to the 500 ft. level without delay. During the month of July the mill treated about 3600 tons, on a daily average of about 120 tons. The average value of the mill heads was about $5.70 and recovery amounted to upwards of 94 per cent. The total amount of bullion recovered was well over $20,000. Total cost was approximately $5.00 a ton.

The Canadian Mining and Finance Company has decided to develop the Gillies claim. A shaft will at once be started about 200 ft. from the Vipond line. It will be carried to the 500 ft. level without delay. As the Vipond has developed to within a few feet of the party wall dividing the two properties, the chance of picking up the extensions of their vein is considered excellent. The shaft will be sunk in the most convenient place obtainable, in the country rock.

The Hollinger will very soon be connected with the main working shaft, to the Millerton. A long crosscut from the Hollinger to the No. 6 shaft of the Millerton is within 125 ft. of its objective. Some years ago, when the Millerton was being prospected, a shaft was sunk to the 100 ft. level and the orebody developed; this orebody is about 100 ft. wide and appears to have an average grade of about $7. The connection between the two properties will be made at the 425 ft. level; the main working level of the Hollinger. The ore will be drawn from the Millerton to the central hoisting shaft of the Hollinger by electric locomotives.

The McIntyre has consolidated its holdings by the purchase of the Pearl Lake Mining Company. The official announcement of the new president, Col. A. M. Hay, states that the Pearl Lake shaft will be used as a central hoisting shaft for all operations of the McIntyre on the north side of the lake. The shaft, which is now down on the Pearl Lake to 650 ft., will be carried down to the 750 ft., from which level operations both on the Pearl Lake and the No. 5 vein system on the McIntyre will be conducted. In the sale the McIntyre is obliged to expend $1,000 a month on development on Pearl Lake. For control the McIntyre paid $47,000 and obtained 1,020,000 shares of the new company formed, called the McIntyre Extension, Limited. This amount liquidates all debts with the exception of those held by B. E. Cartwright. For his $157,000 B. E. Cartwright gets 980,000 shares of the new McIntyre Extension stock.

The deal whereby the McIntyre was to obtain control of the Jupiter has fallen through.

At the Schumacher mill all the machinery is in place, but final adjustments have yet to be made. It is fully expected, however, that a trial run will be made on or about August 25th.

The option on the Gibson claim at Good Fish have been taken up by the Buffalo syndicate, of which Mr. Frank Loring is the head. The second payment on these claims was to be made on August 20th. So good are they looking that it is likely that further payments will be anticipated and the full purchase price will be paid the owners the middle of this month.

COBALT, GOWGANDA AND SOUTH LORRAIN

The continued low price of silver and the great uncertainty of the market owing to the war has caused considerable pessimism among mine managers and mine owners in the Cobalt camp. It is not estimated that the price of silver is now such that profits cannot be made; but rather the fear of a much lower price owing to inability to sell silver at its present quoted value. It is believed that great stocks of silver are being held in the large money centres of the world. It is also known that many silver-lead deposits which were not being worked previously have, owing to the high price of lead, been opened up again. Although the silver produced is a by-product, it nevertheless amounts to a great deal in the aggregate, and is accumulating fast. It is also stated that China is selling rather than buying silver. India is not buying, although the monsoon is good and the estimated crops are much larger than last year. Rumors have been circulated that several mines have determined to close down, but this rumor so far has no foundation; on the other hand the opinion that the normal situation will be resumed after the war is over is reflected in the disposition to open up old silver prospects. Money is now available for the financing of companies to do developing which was not obtainable six months ago. A case in point is that of the United States Cobalt; a prospect which has not been worked since 1907. The Rochester, the Old Pan Silver, the Shamrock, the Columbus and the Twentieth Century are all prospects which have been closed down and which are now working or about to be worked in a very short time.

Bullion shipments, which practically ceased at the latter part of July, have been resumed again in full volume, as companies appear to feel there is little chance of a betterment in price within the next month or six weeks. The ore shipments continue about normal, as smelters are quite willing to take all ore shipped at current prices and pay for the same in full on the usual terms.

Litigation in regard to the Gould lease having now been settled, that lease passes out and is replaced by the Mercer Silver mines flotation, closely identified with the Seneca Superior Mines, Limited. The Gould has already been pumped out by the new company and work has been resumed. Development will be carried on energetically and with good promise of success. The new company which is to take up the lease of the United States Cobalt property, just north of the Hudson Bay mine, is a Rochester flotation, and will be known as the Genessee Silver Mining Company. Although this property is in the conglomerate, it has not been worked since the very early days of the camp. Beyond the sinking of a 60 ft. shaft no work has ever been attempted here. A few strong calcite veins have been found on the surface, but silver values are very low. It is intended to sink a shaft down to within measurable distance of the contact with the Keewatin before any lateral work is attempted.

The Trethewey Cobalt Mining Company has definitely assumed control of the Rochester prospect in Southeast Coleman. It is expected that terms will be arranged whereby the Trethewey will be able to use the shaft and workings of the Lumsden in order to carry out exploration work on the Rochester. This will be all the easier since a crosscut was run into the Rochester for the purpose of exploration by the Lumsden, some time ago. The old shaft on the Rochester is being pumped out, but it is not anticipated that much development will be attempted there.

The Nipissing Mining Company in July produced two or three thousand dollars' worth more ore than in the preceding month of June. The shipments, however, showed a falling off of almost $100,000. Of the 179,998 oz. produced, 99,039 oz. is credited to high grade ore and 80,959 oz. to low grade ore. The high grade mill treated 37 tons and shipped 550,221 oz. of silver, and the low grade mill treated 69.60 tons. There is nothing of particular interest at the main working shaft No.

73, beyond the fact that, two branch veins on the 4th level are proving of sufficient interest to warrant more exploration. No. 80 is again being worked. It is of interest to know that some crosscutting is being done from the second level on shaft 64 into new territory. From the tunnel level, where work has been resumed, No. 96 vein is showing much improvement. It was at first but a small vein of low grade ore; it is an inch wide of 2,000 oz. ore. On Peterson lake, where two drills are developing veins found by the hydraulic last year, the best vein assays 2,000 oz. over a width of two inches.

In Gowganda the once notorious mine known as the Bartlett failed to elicit a bid of more than $6,000 at a recent sale. As this did not nearly reach the reserve placed by the liquidators on the property, it was withdrawn.

It is most probable that the Kerr Lake Mining Company will take over the old Drummond, now known in the camp as the Cobalt Comet. The Kerr Lake already have a half interest in the Drummond Fraction, which is the buffer property between the Kerr Lake and the Cobalt Comet. They will be able to work the whole of the ground very conveniently. The Drummond was bought by Messrs. E. P. Earle and David Fasken at the time the proposal to pump out Kerr lake was made. The Drummonds objected, and the settlement was only made after the case had been taken to the Privy Council. On purchasing the property the new owners sold 6½ acres under Kerr lake to Crown Reserve and the Kerr Lake Cos., so that they might be able to pump out the lake. This 6½ acres was worked jointly by the two companies as the Drummond Fraction. The remainedr was incorporated as the Cobalt Comet; the holding Company in New York being the Caribou Cobalt.

Construction has been commenced on an addition to the Coniagas mill, which will enable that company to re-treat their slime tails and cyanide them. The mill tails from the Coniagas now amount to 70 or 80 tons a day of the 180 tons treated. These slimes, which are now running to waste, contain about 6 oz. of silver to the ton, and it is expected that the new addition will make a further saving of 3 oz. a ton. To treat the slimes 24 canvas tables will be installed. The canvas will be laid on a concrete floor as in the old mill. From the 70 to 80 tons of slime tails, it is expected that about 4 tons of concentrates will be produced. To treat these concentrates a small cyanide plant will be built. The other 3 tons will come from the slimes produced at the trommels and the drag classifier. This product assayed about 100 oz. to the ton and previously has been shipped direct to the smelter. It will now be treated.

INTERNATIONAL NICKEL.

According to the Boston News Bureau, the International Nickel Company may capitalize a portion of its surplus before the end of the current year. This item now approximates $7,000,000, and as the company needs a working capital of not more than $1,000,000, a good dividend is probable. Monthly net earnings of the company are said to be running close to $850,000. With practically a monopoly of the nickel industry, at least on this side of the Atlantic, the International Company has been enjoying a wonderful business from ordinary as well as "war" demand sources. Its ore supply comes from Canada, while the refining takes place in New Jersey. The ore carries important copper values and of late the copper production has been averaging about 3,000,000 lb. monthly. Thus in additon to its sales of nickel at high prices the International Company has been deriving substantial benefits from the high copper prices.

CONIAGAS.

Cobalt, August 8.

The Coniagas is the latest mining company in the Cobalt camp to erect a cyanide mill. The erection of a small one is now in progress on the property, and is expected to be completed and in running order in about two months' time. It is the intention of the management to retreat the present slime tailings as is being done by the Mining Corporation of Canada in the new mill put in operation a short time ago. The tailings will be retreated over canvas, and for this purpose over 4,000 square yards of canvas will be used. The concentrates from the canvas table will in turn be treated in the cyanide plant along with the mill tailings. The precipitate obtained will be refined at the company's smelter at Thorold, Ont. The construction of the new plant will make possible the recovery of the silver remaining in the slimes from the mill, which have all along been going to waste.

DOME MINE.

Dome Mines Company has declared an initial quarterly dividend of 50 cents a share. This places the stock on a 20 per cent. per annum basis. The dividend is payable September 1, to stock of record August 23. As new stock recently offered to shareholders at par is payable August 16, it will participate in dividend just declared. The Dome Mines Company mill has a capacity of about 28,000 tons a month but through the substitution of rolls for the existing 80 stamps at a very small cost, it is expected that capacity will be increased to about 45,000 tons a month. Capt. De Lamar, president of the company says:

"The larger production should be attained by the end of the current year with no interruption to operations during alterations. But this does not measure the productive capacity a year or two ahead for a new mill to treat 3,000 tons of ore daily will be started just as soon as the mine has been opened up sufficiently to furnish the ore. From a position of having no working capital to prosecute development work the Dome Company now has $500,000 from earnings and with payments made for new stock lately offered stockholders at $10 a share it will soon come into possession of an additional like sum to be devoted to development. During the past four months substantial results have been accomplished particularly in the work of increasing ore reserves. At the present time they approximate $15,000,000 to $18,000,000 of $8 ore which as on March 31 they aggregated but $11,000,000. Two years ago reserves amounted to $2,375,000 of $7.50 ore. Material savings in costs have been effected during the past year, the average for the final period being $2.96, a drop of $1.23 a ton. Since March the cost has been further lowered to about $2.25 a ton with additional savings in sight. The mill has been extracting more than 93 per cent. but in the future it is expected that tonnage will be crowded more than heretofore, somewhat at the expense of recovery. In dollars and cents the net return from a greater tonnage and slightly lower extraction would be more beneficial from stockholders' point of view."

MARKETS

TORONTO MARKETS.

Aug. 10—(Quotations from Canada Metal Co., Toronto)—
Spelter, 25 cents per lb.
Lead, 6¾ cents per lb.
Tin, 40 cents per lb.
Antimony, 40 cents per lb.
Copper casting, 20 cents per lb.
Electrolytic, 20 cents per lb.
Ingot brass, yellow, 13c.; red, 15 cents per lb.
Aug. 10—(Quotations from Elias Rogers Co., Toronto)—
Coal, anthracite, $7.50 per ton.
Coal, bituminous, $5.25 per ton.

NEW YORK MARKETS.

Aug. 6—Connellsville coke (f.o.b. ovens)—
Furnace coke, prompt, $1.50 per ton.
Foundry coke, prompt, $2.10 to $2.40 per ton.
Aug. 6—Tin, straits, 34.62½ cents.
Copper, Prime Lake, 18.12½ to 18.37½ cents.
Electrolytic copper, 17.87½ to 18.12½ cents.
Copper wire, 19.25 to 19.50 cents.
Lead, 5.00 to 5.25 cents.
Spelter, 16.50 to 16.75 cents.
Sheet zinc (f.o.b. smelter), 21.00 cents.
Aluminum, 32.00 to 34.00 cents.
Nickel, 50.00 to 52.00 cents.
Platinum, soft, $40.00 per ounce.
Platinum, hard, 10 p.c., $42.00 per ounce.
Bismuth, $2.75 to $3.00 per lb.
Quicksilver, $92.00 to $94.00 per 75-lb. flask.

SILVER PRICES.

	New York. cents.	London. pence.
July—		
24.	47¼	22⅞
26.	47⅜	22½
27.	47⅜	22½
28.	47⅛	22½
29.	46⅞	22 5/16
30.	47⅛	22 5/16
31.	47⅛	22 7/16
August—		
2.	47⅛	22 5/16
3.	47⅛	22 7/16
4.	47⅛	22 7/16
5.	47	22 7/16
6.	47⅛	22 7/16

STOCK QUOTATIONS.

(By courtesy of J. P. Bickell & Company, Standard Bank Building, Toronto.)

New York Curb.

	Bid.	Ask.
Alaska Gold	32.37½	32.75
British Copper	.50	1.00
Braden Copper	7.75	7.87½
California Oil	306.00	310.00
Chino Copper	44.75	44.87½
Giroux Copper	.50	1.50
Goldfield Cons.	1.25	1.28⅛
Green Cananea	40.00	42.00
Granby	83.00	84.00
Inspiration Copper	33.12½	33.37½
International Nickel	180.00	182.00
Miami Copper	25.87½	26.00
Nevada Copper	1.62½	1.75
Ohio Oil	147.00	149.00
Ray Cons. Copper	22.12½	22.37½
Standard Oil of N. Y.	198.00	200.00
Standard Oil of N. J.	410.00	416.00
Standard Oil (old)	1375.00	....
Standard Oil (subs)	975.00	....
Tonopah Mining	5.00	5.37½
Tonopah Belmont	3.87½	4.12½
Tonopah Merger	35.00	37.00
Yukon Gold	2.25	2.62½

Porcupine Stocks.

	Bid.	Ask.
Apex	.02¾	.03
Dome Extension	.19¼	.20½
Dome Lake	.26	.26½
Dome Mines	21.75	22.50
Foley O'Brien	.30	.33
Hollinger	.24	.25
Jupiter	.11¼	.11½
McIntyre	.46¾	.47
Moneta	....	.08
Pearl Lake	.03⅛	.03½
Porcupine Gold	....	.00¾
Porcupine Imperial	.06½	.06¾
Porcupine Crown	.70	.80
Preston East Dome	.04⅞	.05¼
Porcupine Vipond	.61½	.62½
Porcupine Tisdale	....	.02⅛
West Dome	.08¾	.09

Cobalt Stocks.

	Bid.	Ask.
Bailey	.02½	.02¾
Beaver	.27	.29
Buffalo	.35	.55
Chambers Ferland	.12	.15
Coniagas	3.65	4.00
Crown Reserve	.40	.43
Foster	....	.04
Gifford	.01½	.02
Gold Reef	....	.00¾
Gould	.00¼	.00¾
Great Northern	.02	.02¼
Hargraves	.01	.01½
Hudson Bay	.19	.22
Kerr Lake	3.00	3.50
La Rose	.44	.54
McKinley	.18	.22
Nipissing	5.00	5.25
Peterson Lake	.18½	.19
Right of Way	.03½	.04
Silver Leaf	.02	.02½
Teck Hughes	.05	.06
Temiskaming	.30¼	.30¾
Trethewey	.10	.12
Wettlaufer	.03	.05
Seneca Superior	....	.90
Homestakes	.17	.19
York, Ontario	.01½	.04

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

Ontario
Cohen, S. W.
Campbell & Deyell.
Carter, W. E. H.
Ferrier, W. F.
Forbes, D. L. H.
Gwillim, J. C.
Hassan, A. A.
Haultain, H. E. T.
Segsworth, Walter E.
Smith, Alex H.
Smith, Sydney.
Maurice W. Summerhayes.
Tyrrell, J. B.

Quebec
Burchell, Geo. B.
Cohen, S. W.
DePencier, H. P.
Hardman, J. E.
Hersey, Milton L.
Johnson, W. S.
Smith, W. H.

British Columbia
Brown & Butters.
Fowler, S. S.

FOREIGN-New York
Canadian Mining & Exploration Co., Ltd.
Colvocoresses, Geo. M.
Dorr, Jno. V.N.
Hassan, A. A.

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BROWN & BUTTERS
Mining Geologists and Metallurgical Engineers
PRINCE RUPERT, B.C.

BURCHELL, GEO. B.
Mining Engineer
Lignite and Bituminous Coal Mining
Examinations and Reports
505 McGILL BLDG., MONTREAL

CANADIAN MINING AND EXPLORATION CO., LIMITED
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Memoir 65. Clay and Shale Deposits of the Western Provinces (Part 4), by H. Ries.

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Museum Bulletin 11. Physiography of the Beaverdell Map Area and the Southern Part of the Interior Plateaus of British Columbia, by Leopold Reinecke.

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Memoir 67. The Yukon-Alaska International Boundary, between Porcupine and Yukon Rivers, by D. D. Cairnes.

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Map 91A. Geological map of the Dominion of Canada and Newfoundland. Scale 100 miles to 1 inch

NEW BRUNSWICK AND NOVA SCOTIA.

Map 27A. Bathurst and vicinity, Gloucester County, New Brunswick. Geology.

Map 39A. Geological Map of Nova Scotia.

Map 121A. Franey Mine and Vicinity, Victoria County, N. S.

QUEBEC

Map 95A. Broadback River, Mistassini Territory, Quebec. Geology.

Map 100A. Bell River, Quebec. Geology.

ONTARIO

Map 124A. Wanapitei (Falconbridge, Street, Awrey, and Parts of Maclennan and Scadding Townships), Sudbury District, Ont. Geology.

Map 49A. Orillia sheet, Simcoe and Ontario Counties, Ontario. Topography.

NORTH-WEST PROVINCES

Map 55A. Geological map of Alberta, Saskatchewan and Manitoba.

Map 117A. Wood Mountain Coal Area, Saskatchewan.

BRITISH COLUMBIA

Map 33A. Nanaimo sheet, Vancouver Island, British Columbia. Topography

Map 70A. Victoria sheet, Vancouver Island. Geology.

Map 72A. Saanich sheet, Vancouver Island. Geology.

Map 109A. Prescott, Paxton and Lake Mines, Texada Island. Topography.

YUKON AND NORTH-WEST TERRITORIES

Map 113A. Canadian routes to White River District, Yukon, and to Chisana District, Alaska.

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Continued on page 23.

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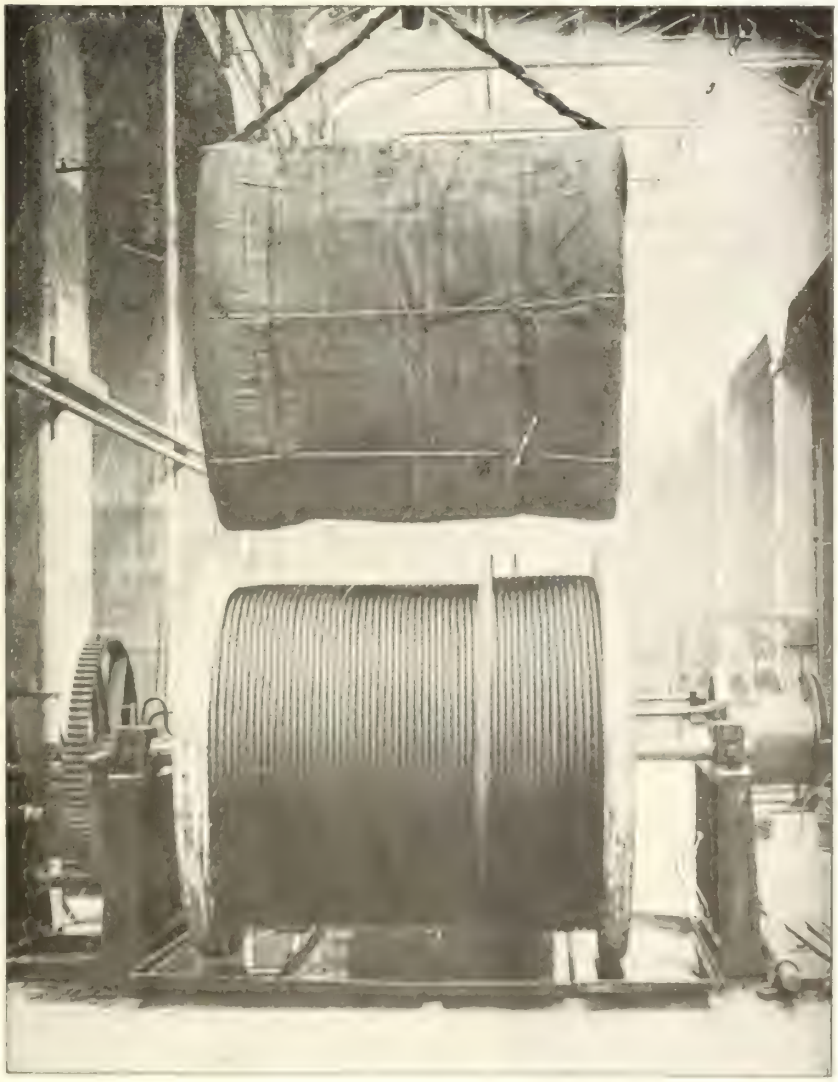

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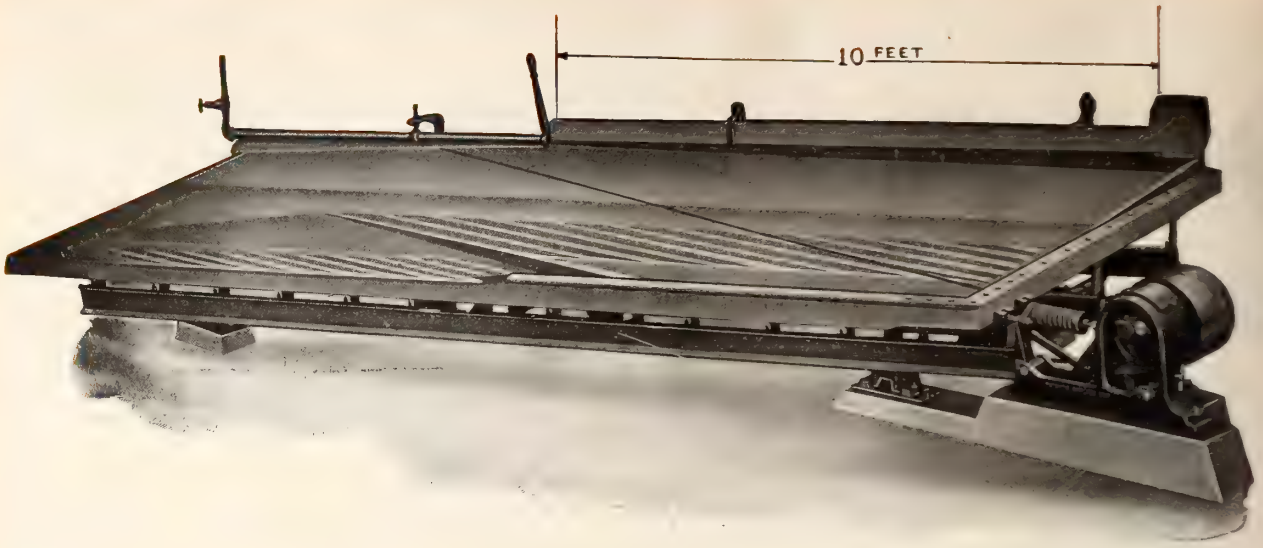

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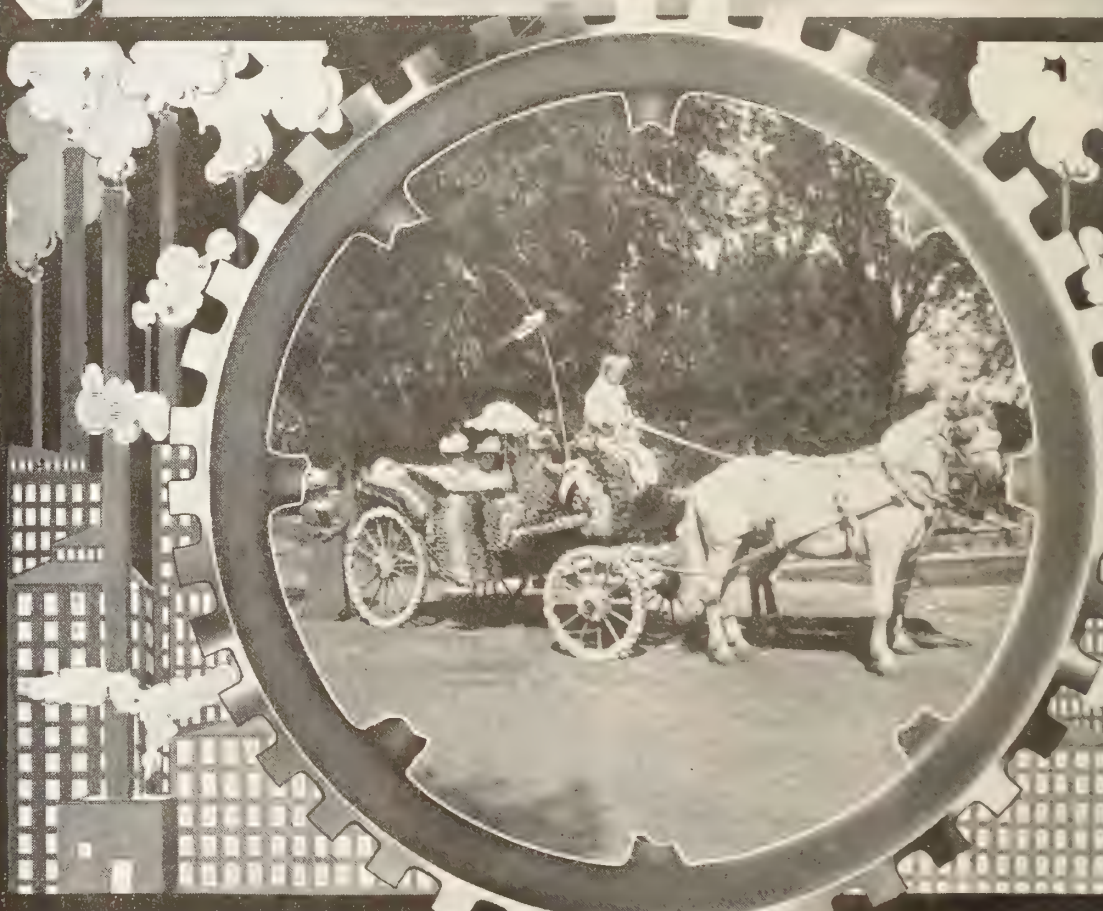

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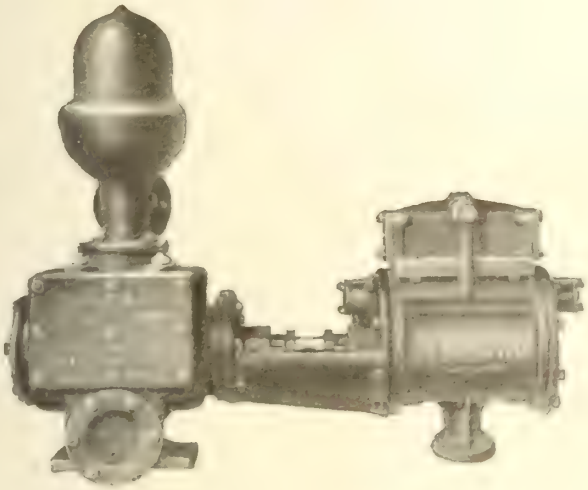

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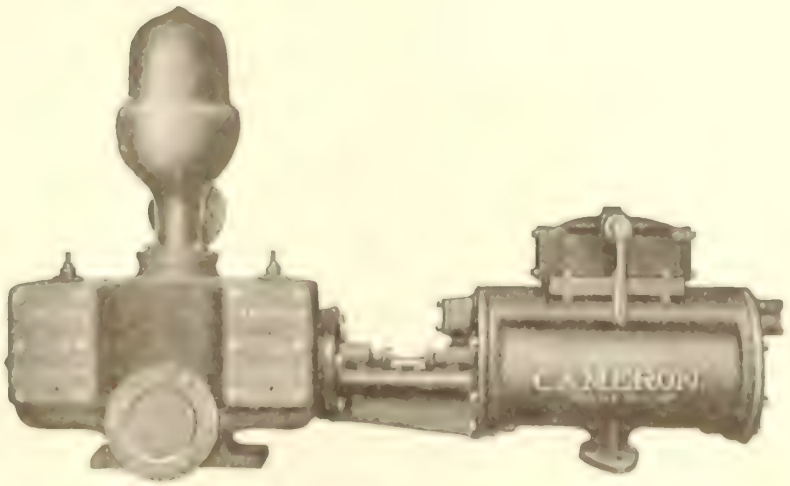

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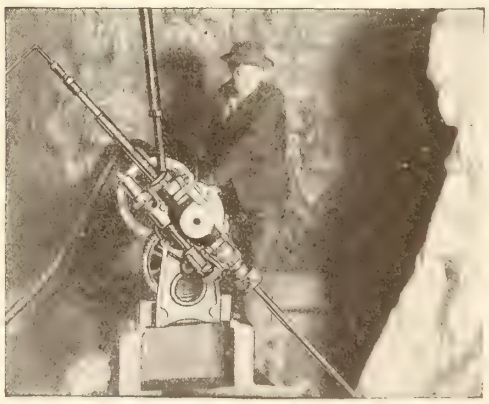

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The holder of the certificate may stake mining claims to the extent of 200 acres.

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SIX MONTHS AFTER STAKING. At the expiration of six months from the date of the staking, the prospector, to retain his rights, must take out a mining license.

MINING LICENSE. The mining license may cover 40 to 200 acres in unsurveyed territory. The price of this license is Fifty Cents an acre per year, and a fee of $10.00 on issue. It is valid for one year and is renewable on the same terms, on producing an affidavit that during the year work has been performed to the extent of at least twenty five days labour on each forty acres.

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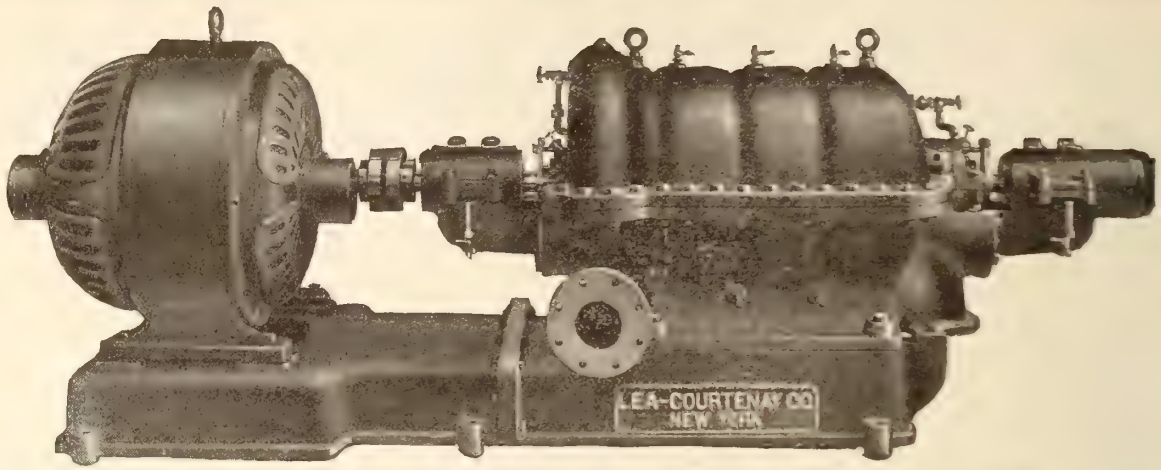

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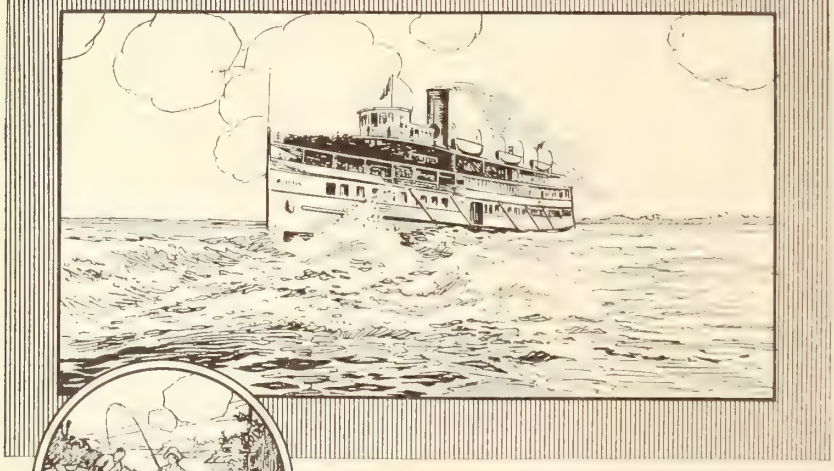

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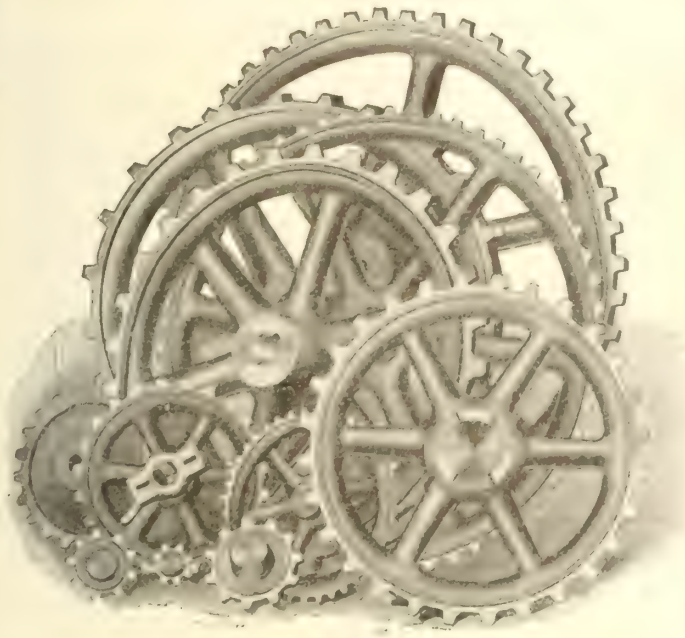

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COAL mining rights of the Dominion, in Manitoba, Saskatchewan and Alberta, the Yukon Territory, the North-West Territories and in a portion of the Province of British Columbia, may be leased for a term of twenty-one years at an annual rental of $1 an acre. Not more than 2,560 acres will be leased to one applicant.

Application for a lease must be made by the applicant in person to the Agent or Sub-Agent of the district in which the rights applied for are situated.

In surveyed territory the land must be described by sections, or legal sub-divisions of sections, and in unsurveyed territory the tract applied for shall be staked out by the applicant himself.

Each application must be accompanied by a fee of $5 which will be refunded if the rights applied for are not available, but not otherwise. A royalty shall be paid on the merchantable output of the mine at the rate of five cents per ton.

The person operating the mine shall furnish the Agent with sworn returns accounting for the full quantity of merchantable coal mined and pay the royalty thereon. If the coal mining rights are not being operated, such returns should be furnished at least once a year.

The lease will include the coal mining rights only, but the lessee may be permitted to purchase whatever available surface rights may be considered necessary for the working of the mine at the rate of $10.00 an acre.

For full information application should be made to the Secretary of the Department of the Interior, Ottawa, or to any Agent or Sub-Agent of Dominion Lands.

W. W. CORY, Deputy Minister of the Interior.

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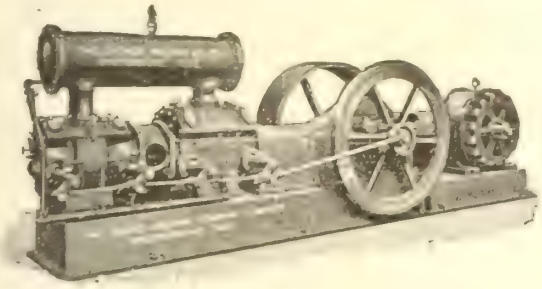

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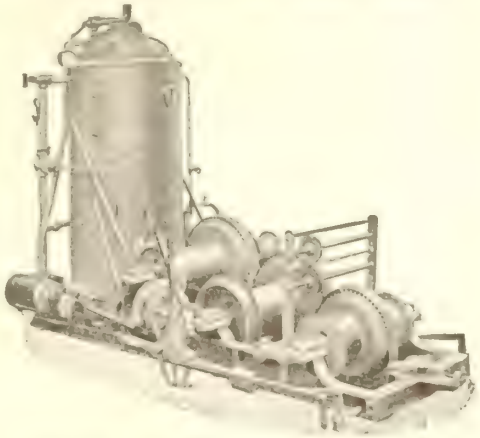

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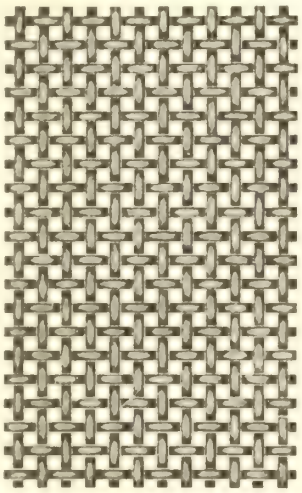

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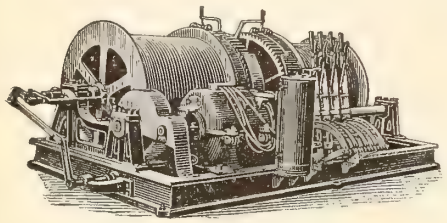

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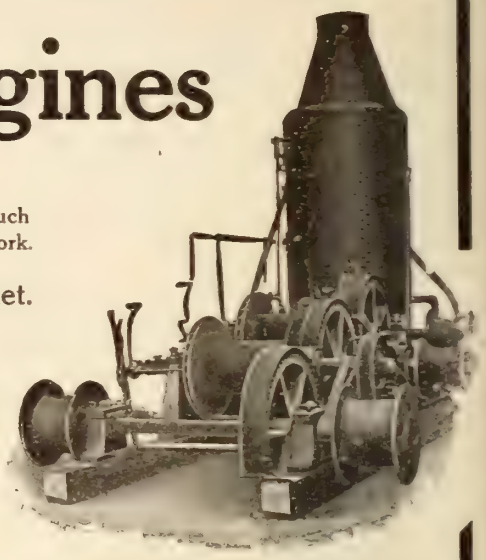

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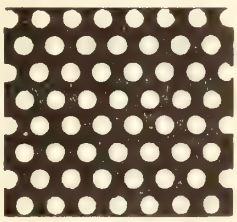

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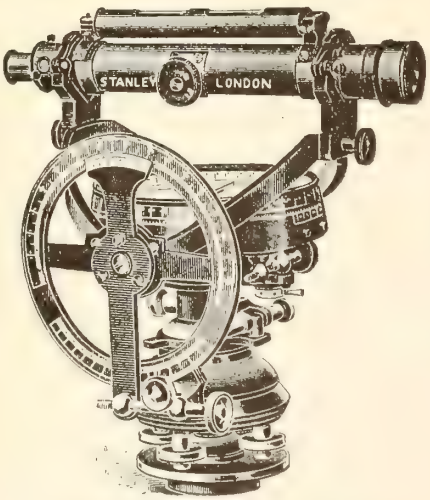

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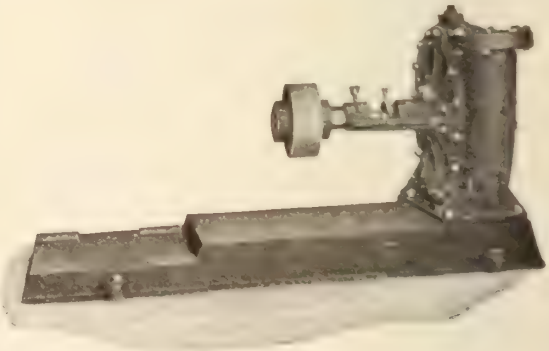

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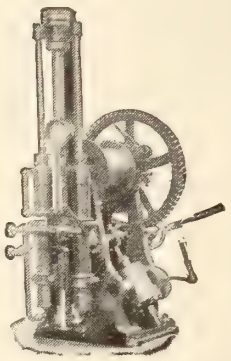

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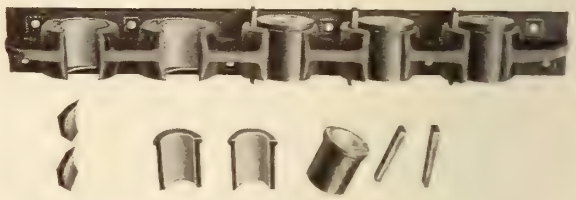

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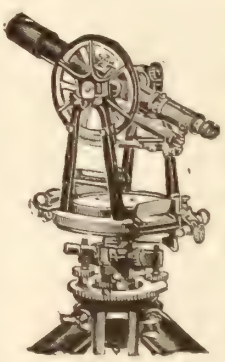

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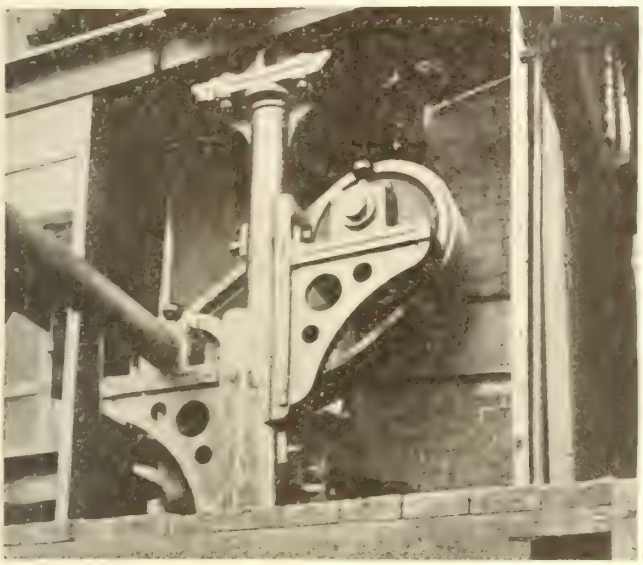

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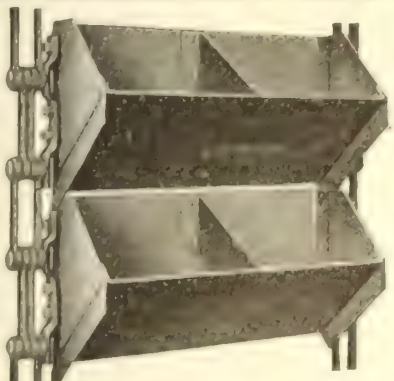

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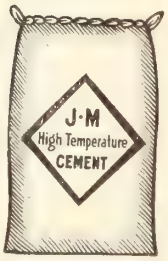

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OUR DISABLED SOLDIERS

Canadians are responding nobly to the call to arms. In the early days of the war few of us understood that Great Britain, with her little regular army, would undertake important operations on land. Then came the announcement that the first army had been transported to the Continent to support the gallant Belgians. Soon others followed, and the magnificent fight put up by the small British force in the retreat to the Marne and in the saving of Paris and Calais, showed that, even in these days of huge continental long-trained armies, Britain's force on land was not to be despised. Gradually the force has been increased and it is now reported that the British hold 100 miles of the line in Belgium and France, as well as undertaking the major part of the task at the Dardanelles.

Events show that Britain must and will take an ever-increasing part in the land battles as the war goes on. In these battles Canada will be well represented. So far we have undertaken to furnish [illegible] for overseas service. We must be prepared to send more.

It is to be expected that a large percentage of Canadian soldiers will be killed or wounded. They are going to Europe to fight, and they will fight hard. Our first contingent did so at St. Julien in April and wherever those that survived, have had an opportunity since. Those who follow will uphold the reputation made by the first contingents in the face of the Hunnish poison gas attacks.

We all delight in reading of the valor of our troops. We are glad to learn that Canadians can hold their own on the battlefield with the best trained soldiers of Europe. But our thanks should not be expressed merely in congratulatory messages. We must assume other duties, provide for those unfortunates, and there will be many of them, who cannot [illegible] The way is open.

The Government has appointed a Commission, called the Military Hospitals Commission, of which a member of the Government is the president, to administer out of the public funds the construction of military hospitals and convalescent homes for sick and wounded soldiers. Upon discharge from these hospitals and homes the disabled will receive pensions at fixed rates.

These pensions, while somewhat larger per [illegible] than those allowed to the British soldiery, are in numerous instances by no means sufficient to meet the needs of the recipients and to the end of further assisting them in the making of their livelihood, the Government is, in response to many suggestions, creating a fund — to be known as the "Reclamation Fund." The proportion of the moneys that [illegible] by the pensioned soldier would depend upon its amount. If a sum is ob-

tained which will produce from investments a sufficiently large revenue, this income might alone be expended, but if not large enough to enable this to be done, both capital and income would be distributed upon well defined lines. Each case would be treated upon its merits, and assistance given in many ways. For instance, a totally disabled man could have his pension augmented by a sum to enable him to obtain additional physical comforts, while a partially disabled man, if unable to follow his former employment, would be assisted to take up some new occupation within the scope of his crippled ability.

Communications as to this fund should be directed to Mr. E. H. Scammell, secretary, Military Hospitals Commission, 22 Vittoria Street, Ottawa.

THE EMPLOYMENT OF ALIEN ENEMIES IN THE PRODUCTION OF COAL AND STEEL AND OTHER MUNITIONS OF WAR

For some time past there has been manifest in this country a desire to dismiss from employment all alien enemies. This cry is confined to a small section of the population, but it is a section that is noisy out of all proportion to its size and importance. The agitation is ostensibly based on patriotic motives, but it is to be feared that it has its origin in much baser things, and that the general objection to the "foreigner" is being used by designing agitators and irresponsible news sheets under the gloss of a spurious patriotism and an appeal to the lowest human passions. Reference was made to this danger in the Journal of June 1st in an article which had for its main arguments the fact that "alien workmen are assisting in the production of coal and steel, upon which to a very large extent depends the ability of Canada to manufacture munitions of war and to transport these munitions and men to the battle line," and the further statement that these alien enemies "so long as they pursue their peaceful avocations and indulge in no overt acts, should be allowed to earn their daily bread and otherwise be treated as potential citizens of this great Dominion."

Between the date of this article and the present time a section of the miners and steel workers—principally confined to the mainland coal fields of Nova Scotia—have taken the stand that they will not work with alien enemies, urging that these men should be immediately interned. The men who have taken this stand are without doubt sincere in their attitude, but their logic is hopelessly twisted. The purpose of internment camps is usually understood to be the removal of alien enemies to a place of safekeeping where it will not be possible for them to indulge in espionage and active hostility, or to escape to neutral countries from whence they may be able to return to Germany or Austria. In short, it is to prevent alien enemies from performing service for their own countries. But what is being urged with reference to alien enemies employed in Canada is the very reverse. To-day these men are doing service for Britain and the Allies, digging coal, working steel, making shells, building railway cars, and helping materially the cause we all have at heart. At the same time these men are supporting their families, swelling the savings banks deposits of Canada, and in the great majority of cases are, in the words of the Government's proclamation, "peacefully pursuing their daily avocations." If these aliens should be forcibly interned, they at once, together with their families, become a source of expense to the country; peaceful men are turned into sullen enemies, confined in internment camps in enforced idleness; still greater drafts must be made on the defence forces of the country to guard these camps, and every department of civil administration will require to be on guard against office-seekers and would-be "grafters" and that type of citizen who regards the multiplication of internment camps as meaning fresh "jobs" and opportunities to make money out of the Government.

Very many of the so-called alien enemies are men who have been attracted to Canada by the widespread and elaborate advertising programme that has been pursued throughout Europe by the Immigration Departments of the various Canadian Provinces. In very many cases also the sympathy of aliens of belligerent nationality with their own country's policy is doubtful. The Bohemian Czech has no love for Austria, the Galician or Russian Pole, the Roumanian from Transylvania, the Austrian from the Trentino, may be assumed to view the progress of present events without any overwhelming love for Austria or Germany. These men left their birthplace, in most instances, to escape the very evils of militarism that Britain is now combating. They came to Canada as a refuge from oppression, a free land for freemen, and they are entitled at least to the benefit of the doubt, and the spirit of fair play that the Briton boasts he possesses.

The German propaganda in the United States has been directed to the stopping of the manufacture of munitions of war in that country for the Allies, and dire threats have been breathed through the press of that country against Germans who should dare to help in the manufacture of munitions. And here in Canada there are persons who propose that alien enemies should be prevented from working, not because they are dangerous men, but simply and solely because they are Germans and Austrians. In other words, our enemies should be imprisoned not because we are afraid of them, but because we hate them. Our actions are to be guided not by reasons of military advantage or necessity, but by the unreason of hatred. And this in a country which has laughed itself hoarse over Lissauer's Chant of Hate!

The miners who think they are serving the country by refusing to work with Austrians and Germans, not because they fear them, but because they don't like them, should read Lloyd-George's appeal to the miners of Great Britain, and his presentment of the all-para-

mount importance of coal to Britain and the Allies in the successful prosecution of this war.

Mr. Lloyd-George says: "In peace and war King Coal is the paramount lord of industry. It is our real international coinage. We pay not in gold, we pay in coal. We cannot do without coal. In war it is life for us and death for our enemies. It not merely fetches and carries for us, it makes the material and machinery which it transports. It bends, it moulds, it fills the weapons of war. Steam means coal. Rifles mean coal. Machine guns mean coal. Cannon means coal. Shells are filled with coal. The very explosive inside them is coal, and then coal carries them right into the battlefield to help our men. Coal is everything for us, and we want more of it to win victory. Coal is the most terrible of enemies, and it is the most potent of friends."

The miner who refuses to mine coal because Germans and Austrians are also helping in the work is grievously mistaken if he thinks that in taking this stand he is helping the Empire. He is most efficaciously helping the Kaiser.

The illogical position taken up by those who refuse to work until the alien enemies are dismissed is so absurdly obvious as to lead one to hope that if the case were properly presented to these men they would reverse their present attitude, and it would appear incumbent on the Canadian Government to make an official pronouncement on the question. Surely the ways of politics are not so devious in Canada that some responsible member of the Cabinet cannot see his way to put this matter fairly and squarely before the workers of the country.

It may be definitely and authoritatively stated that no employer of labor in Canada would wish for a single moment to displace Canadian labor by alien enemies, but where the production of munitions of war is being hampered by a shortage of labor, what possible objection can there be to utilizing the aliens now in the country?

The Germans are using the machine shops at Liege and Herstal in Belgium, the iron mines of French Lorraine, the iron works around Lodz in Russian Poland, and as far as possible are making use of the working population in the occupied districts. If the Kaiser has any sense of humor he should be hugely tickled when he hears of our workmen going on strike because German are being allowed to help the Kaiser's enemies.

The recruiting during July and August in the Nova Scotia mining districts has been heavy and it is estimated that twenty per cent. of the workmen at the mines have now joined the military forces.

Owing to the demand for copper the output of precious metals by copper mining companies is much larger than usual. During the year ending June 30 Granby Consolidated, Canada's largest producer of copper, produced over 400,000 oz. of silver, obtained in treating the copper ores.

WESTERN FEDERATION METHODS

In a recent issue of "Life," the well-known New York weekly, appears a protest against the conviction of John Lawson for murder committed during labor troubles in Colorado. "Life" protests on the ground that Lawson did not himself commit the murder.

Among the readers of "Life" is Mr. Homer Guck, editor of the "Mining Gazette," published at Houghton, in the Michigan copper country, the scene of the last big strike brought about by the leaders of the Western Federation of Miners. The impression made on Mr. Guck by the methods of the Western Federation leaders is exhibited in his open letter to "Life", dated August 10, 1915. Throughout the Michigan copper mining district are thousands who, since their experience with the Federation, share Mr. Guck's views concerning agitators. The letter says, in part:

"I remember four or five years ago reading articles in the socialistic magazines that were spread all over this section of ours preliminary to the entrance of the gangsters of the Moyer stripe, telling of the terrible conditions among the miners of Colorado and West Virginia. And I thanked goodness that there were no such conditions here, that we had lived in peace and prosperity and happiness for some fifty years or more with our mines and our miners and our citizens all doing pretty well and enjoying a happy family life. Then when the same gang that put out the tales about West Virginia and Colorado entered this district and began to spread the same awful lies about Michigan copper mines that they had used about the other states we awoke to the fact that if they were no more truthful about Colorado and West Virginia than they were about Michigan you couldn't believe much of them.

"E. O. J. says in your magazine that this man Lawson was convicted of a murder that he did not do. One night when our strike was at its very worst a gang of gunmen deliberately shot into a home occupied by an English family. They killed two innocent men as they slept in their beds. They wounded a little girl. These gangsters shot from a nearby woods. They were sneaking cowardly murderers of the worst type. There was no clue against the men that murdered. All they wanted to do was to work. They finally got one poor weak-kneed man to states prison for that murder. The real murderer was the man with the brain who filled the other fellows with rotten whiskey, took them to the spot and told them to shoot. The man who went to prison shot, alright, but was he as guilty as the man with the head who directed the work? Lawson directed the work in Colorado and he got what he had coming to him. He was the brains. The others were the tools. And do you want to assert that he goes to prison 'for a murder he did not commit' simply because he bossed the gang and perhaps did not fire the shot? And it is a satisfaction to know that in some parts of the United States at least they are able to send their murderers to prison for their crimes. In nine of ten cases they get away through intimidation of the jurors, evidence of

the judges or shrewdness of their lawyers. And now when they do catch one of these rogues, who have done more to damage the cause of decent union labor than any other single factor, you print an article saying he did not commit the murder. The juries and the judges and the people of Colorado all agree that you are in error. And you, dear 'Life', go to the trouble to expostulate on this subject at some length.

"Before our experience with the Moyer-Tersich-Mahoney gang—you will notice that I change the names around occasionally and work them in differently just for variety's sake—we used to have a lot of respect for the Federal Government and its activities. As a child we remember trying to put peanut shells in a mail box and they told us that we might be sent to jail for tampering with any of Uncle Sam's business. We got over that through the strike experience, too. There were a couple of train attacks, one right in the city limits. A regular evening train, run by union men, including a car with United States mail and loaded with women and children, was shot full of bullet holes by a gang of the same hired gunmen of the Moyer-Mahoney-Yanko crowd, who stood back in the bushes as the train went around a dangerous curve. Nobody was even arrested for that crime if we remember correctly and the examination into the facts by United States officials was ridiculous. And what happened to that Government post office employee who actually was caught in the act of turning mail addressed to one of the mine officials into the hands of the Moyer leaders? Did he go to jail? Never heard a word about it.

"Is it any wonder that it makes one suspect that the gangs of parasitical agitators that live off the men they are able to induce to part with monthly dues, have more political power or more real influence in some quarters, than capital, in its most bloated condition, ever suspected it maintained.

"But I am wandering far and wide. Only that Jones story on the Colorado situation kind of made me sore all over. I know dozens of leaders who came here when our strike started and who are responsible for dozens of crimes, many of them murders, who got away with the money of our people, never ran any risk of jail and are now working in other fertile fields. When they get one of that tribe as they did in Colorado in the Lawson case let's give the Government credit for maintaining some respect for law, even when it does catch agitators of the Lawson type."

A Boston newspaper prints the following statement of a well-informed banker. It helps to show that the agricultural and mineral wealth of Canada are not unappreciated in New England. The banker says:

"I believe that a Canadian loan for $500,000,000, endorsed by the British Government, can be placed on advantageous terms in this country. Let the price be made attractive to the bankers and brokers and investors, and we would quickly have a basis here of international credit and finance. The security would be right next door, and the Monroe Doctrine would have a substantial reality and a financial value. The agricultural and mineral wealth to the north of us should furnish security when backed by British resources to such an extent that half a billion would be only a beginning. Russia and the North American continent hold the real values to constitute a basis for credit in this great war. Here are the values that cannot be exhausted by the war."

Johannesburg reports numerous earth tremors recently. Considering the extent of the excavations it is not surprising that such movements occur, for so-called "air-blasts" have been of frequent occurrence in Michigan deep mines. The cause of the Johannesburg quakes is to be the subject of investigation by a committee recently appointed.

Glace Bay mines of the Dominion Coal Company, broke all previous records in July, producing 462,240 tons coal. The output would have been larger but for the shortage of ships. Considering also that the company has furnished 1,000 men for the armies of Britain and her allies the showing is a very remarkable one and augurs well for the balance of 1915.

ALLEGED SILVER DEPOSITS AT FOND du LAC

Mr Charles Camsell, of the Geological Survey staff, who was sent to Lake Athabaska in the spring to examine the alleged occurrence of deposits of high-grade silver ore, similar to those of Cobalt, at Fond du Lac, has reached Peace River Crossing.

Word has just reached the Department from Mr. Camsell who reports that no high-grade silver ores have been discovered on Lake Athabaska and that there is no warrant in the nature of the rock formation for the rush of prospectors to that region. The only ores found that seem to be possibly of economic importance are pyrrhotite deposits carrying a small amount of nickel. These ores are associated with norite rocks, similar to those with which the nickel is associated at Sudbury, but the percentage of nickel seems to be too small to allow of profitable working in a locality so remote from transportation facilities. Mr. Camsell's report confirms the opinion expressed regarding this region in the reports already published in the summary report of the Department for 1914, which was issued in July of this year. In that report Mr. Alcock, writing of the Fond du Lac locality, states that:

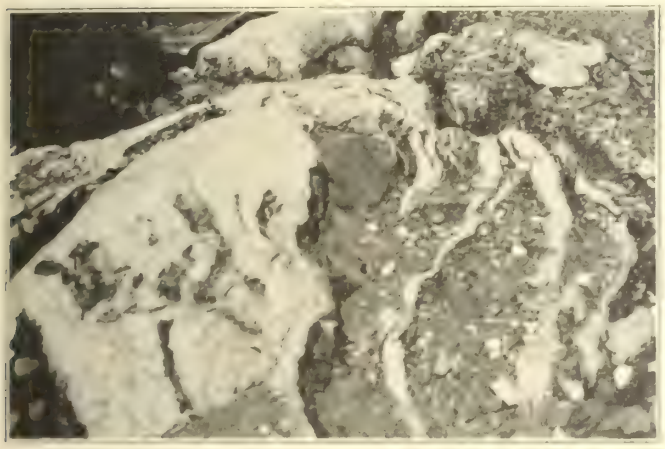
"A number of claims have been staked for nickel on iron-stained outcrops which have the nature of fahlbands in the gneiss. In a number of these, pyrite and pyrrhotite were found, but in very limited amounts. In places in the norite at the east end of the lake, pyrite and pyrrhotite are found disseminated, and along certain fracture zones there has been concentration enough to produce a prominent iron-cap, but in no case was sufficient ore seen to warrant development work. Of a number of assays of pyrrhotite ore, only one showed nickel in workable amount."

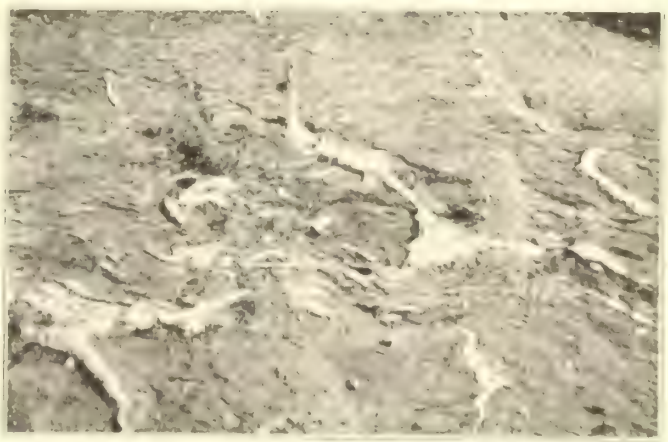
GOLD

Gold is king. The nations of the world are unanimous in giving to the yellow metal a certain value, making it the standard for purposes of exchange. "It embodies and concentrates in the most convenient form," says M. De Launay, of the Ecole Superieure des Mines, Paris, "the product and the apparent end of human labor, the synthesis of effort, which is destined the next moment to be dispersed in the satisfaction of desires, in enjoyments and pleasures, every one of which will be expressible in terms of more or fewer of its particles. Once it has issued from the mine, from the works where it has been extracted and treated, gold runs all over the world playing with complacency, suppleness and

"The deserts of South Africa and West Australia are supplied with water; the foggy steppes of the Arctic Ocean temper their severity; the tropic forests and marshes lose their pestilence: man takes possession of the frozen plains, of the Alpine crest, of the coast desolated by malaria or yellow fever; he brings there, first the most indispensable necessaries, then the conveniences and, finally, the luxuries of existence. Gold may afterwards disappear from the mines, the deposits may be exhausted in a few years, but the beneficent and creative influence remains.

"No other means, no despotic will, would have attained the same end so quickly or so surely. Thanks to gold civilization has brought its resources, its ingenuity,





Gold Quartz, Hollinger Mine, Porcupine, Ont.

the cultures almost untouched by years. As generations pass, a godly flight carries it from one land to another; it goes, sowing joy and prosperity on its way, simply because it is there, because it intervenes like a god without losing any virtue of its own. Not only is gold destined to irradiate human life and to transfigure it by its spell, but it seems as if its discovery on the earth transforms Nature herself and throws down the impassable barriers by which she thinks to arrest the invasion of men and to keep her solitudes for ever untrodden. No sooner has gold been found in a savage, docility the part which is expected of it. It passes down barbarous and uncultivated country, heedless to life itself, than that country is transformed

Gold is derived from two classes of deposits, alluvial or placer, and lode. We cannot here enter at length into the discussion of methods of working such deposits; but it will be well to point out that placers and lodes present very different problems. Placers are sand or gravel deposits containing loose particles of native gold which can generally be separated by agitation with water. Lodes are solid deposits in which the gold is tightly locked. In some cases placers are frozen or otherwise solidified so that some process of disintegration is necessary. In the case of lodes disintegration is always a process which requires great expenditure of power. In many lode deposits moreover simple disintegration does not free the gold, and chemical treatment becomes necessary. Placers therefore are frequently worked very profitably for some time by men of small means without great expenditure for plant, and later operated on a more pretentious scale by the use of more costly apparatus. On the other hand, the working of lode deposits usually requires larger expenditures for plant early in their development. Consequently we find that most lode mines are operated by stock companies, by capitalists or groups of capitalists.

Those who prospect for lode deposits are seldom in a position to mine what they discover, but are encouraged by the fact that operators are continually on the lookout for good prospects. The discoverers of placer deposits usually work their claims, for a time at least.

Placer deposits are usually at or near the surface, while most lode deposits extend to some depth. Naturally from this feature alone great differences in methods arise, for placers can be worked in the open while the greater part of most lodes is more easily extracted underground. Placer deposits have, in most countries, been the first to be discovered and worked, the discovery of lodes following later.

The history of gold mining dates back many centuries. Long before the birth of Christ there were several mining centres in the eastern Mediterranean countries. The mines of Asia Minor and Macedonia were celebrated in the times of Herodotus and Strabo. The enormous wealth of the king of Egypt is supposed to have been largely derived from gold mines east of the Nile. India produced gold ages before the founding of Rome. The Romans had little gold in their own country; but by their conquests took possession of vast amounts. Spain, Portugal and Gaul were large producers of gold during the early days of Rome's greatness.

The discovery of the Americas marks the beginning of a new era in the mining industry. The colonies of Spain and Portugal were made to yield great streams of golden wealth. Africa, Russia and Siberia also outstripped in productivity the old mining centres of Europe. M. De Launay estimates that between 1492 and 1848 the production of gold rose to 636 millions of pounds sterling, or 4,621 tons, of which 80 millions came from America, 100 millions from Africa, 44 millions from Russia and Siberia and 20 millions from Europe. McLaren, however, estimates that during the period 1545-1840 the Portuguese and Dutch obtained 75 millions in Japan alone. Japan has been usually overlooked by historians.

In 1848 wonderful discoveries were made in California. The successful operations of many fortunate ones in that country led both to the phenomenal development of California and to the opening up of mineral deposits throughout the Western States and in British Columbia and Yukon.

Almost simultaneous with the disclosure of the wonders of California came discoveries in Australia. Ballarat and Bendigo became centres of great industry. Then other parts of Australia and New Zealand also were found to be rich in gold.

In 1887 came the discovery of the world's greatest gold field—the Witwatersrand, commonly called the Rand, South Africa. In 1896 wonderfully rich alluvial deposits were discovered in the Yukon and Canada became an important producer. In the United States, Colorado became one of the largest producers after the discovery of rich deposits at Cripple Creek in 1891. In Western Australia rich finds were made in the now famous Kalgoorlie camp in 1892. Kalgoorlie and Cripple Creek are the richest telluride goldfields in the world.

The precious metal deposits at Tonopah, Nev., were discovered in 1900, when the mining industry generally in Nevada had sunk to a very low level. The discovery greatly stimulated prospecting and led to the revival of mining throughout the State. The district has produced silver and gold to the total value of more than $60,000,000.

The discovery of gold at Goldfield in 1902 was a direct outcome of the development at Tonopah. The total production from Goldfield to the end of 1913 was over $65,000,000 in gold and silver.

The Transvaal produced in 1914 8,394,322 oz. fine gold. The total production from the beginning of operations in 1884 to the end of the year 1914 amounted to 102,830,226 oz., valued at over $2,000,000,000. The operating companies have distributed $500,000,000 in dividends. The number of employees during the last five years has averaged over 200,000. Salaries and wages paid during 1914 amounted to over $60,000,000.

In Canada there was little interest in gold mining previous to the great California discoveries. In 1857 rich placers were located on the Fraser, Thompson and Columbia rivers in British Columbia, and that Province has ever since produced large quantities of gold.

In British Columbia, Williams creek and Lightning creek, in the Cariboo district, have been especially productive. More recently discovered placer deposits in the Atlin division, Cassiar district, now surpass in output those of Cariboo. Now outrivalling any of the placers in British Columbia are the lode deposits at Rossland discovered in 1890, and in the Boundary district.

In Nova Scotia the first discovery was made in 1860. Since 1862 Nova Scotia has been a regular though never a very large producer of gold. In Quebec gold was obtained as early as 1823 in the Chaudiere district, and in 1863 rich gravels were found on the Gilbert river. Since that time the district has been the scene of more or less mining activity; though the total production is small. Gold was found in 1865 at Marmora in Eastern Ontario and in 1871 in the Lake of the Woods district, Western Ontario. By far the most important deposits known in Ontario are those in the Porcupine district, discovered in 1909. As early as 1869 gold was known to occur in the Yukon river; but it was in 1897 that the riches of the Klondike were discovered and Yukon became Canada's chief source of the yellow metal. While the amount of gold won by hand methods in the Klondike has fallen off greatly, production is still large owing to the operations being carried on by strong companies working on a large scale with methods and machines specially devised for the novel conditions. The Yukon should continue for years to yield much gold.

A considerable proportion of the gold produced in Canada comes from ores treated by smelting for base metals. Of the total production in 1914 ($15,925,044),

$5,695,508 was derived from placers, $6,050,690 from milling ores, and $4,228,846 from smelter products from ores, concentrates, etc., smelted.

Statistics, prepared by the Mines Branch, Ottawa, of the annual gold production of Canada and the several Provinces are shown in the following tables:

Annual Production of Gold in Canada, 1858-1914.

Year.	Value.	Year.	Value.
1858	$705,000	1886	$1,463,196
1859	1,615,072	1887	1,187,804
1860	2,228,543	1888	1,098,610
1861	2,666,118	1889	1,295,159
1862	2,798,774	1890	1,149,776
1863	4,186,011	1891	930,614
1864	4,126,199	1892	907,601
1865	3,987,562	1893	976,603
1866	3,153,597	1894	1,128,688
1867	3,013,431	1895	2,083,674
1868	2,773,527	1896	2,754,774
1869	2,123,405	1897	6,027,016
1870	1,724,348	1898	13,775,420
1871	2,174,412	1899	21,261,584
1872	1,866,321	1900	27,908,153
1873	1,536,871	1901	24,128,503
1874	2,022,862	1902	21,336,667
1875	2,693,533	1903	18,843,590
1876	2,020,233	1904	16,462,517
1877	1,949,444	1905	14,159,195
1878	1,538,394	1906	11,502,120
1879	1,582,358	1907	8,382,780
1880	1,304,824	1908	9,842,105
1881	1,313,153	1909	9,382,230
1882	1,246,268	1910	10,205,835
1883	1,113,246	1911	9,781,077
1884	1,058,439	1912	12,648,794
1885	1,148,829	1913	16,598,923
		1914	15,925,044

British Columbia—Annual Production of Gold.

Year.	Value.	Year.	Value.
1858	$705,000	1887	$693,709
1859	1,615,072	1888	616,731
1860	2,228,543	1889	588,923
1861	2,666,118	1890	494,436
1862	2,656,903	1891	429,811
1863	3,913,563	1892	399,525
1864	3,735,850	1893	379,535
1865	3,491,205	1894	530,530
1866	2,662,406	1895	1,266,954
1867	2,480,868	1896	1,788,296
1868	2,372,972	1897	2,724,657
1869	1,774,978	1898	2,939,852
1870	1,336,956	1899	4,202,473
1871	1,739,449	1900	4,732,105
1872	1,610,972	1901	5,018,703
1873	1,305,749	1902	5,961,409
1874	1,844,618	1903	5,873,036
1875	2,474,994	1904	5,704,908
1876	1,786,648	1905	5,902,402
1877	1,608,182	1906	5,579,039
1878	1,275,204	1907	4,883,020
1879	1,290,058	1908	5,629,850
1880	1,013,897	1909	5,174,579
1881	1,046,737	1910	5,465,318
1882	954,085	1911	4,790,142
1883	794,252	1912	5,205,485
1884	736,165	1913	6,149,027
1885	713,738	1914	5,177,343
1886	903,651		

Total, $15,778,105.

Nova Scotia—Annual Production of Gold

Year.	Value.	Year.	Value.
1862	$141,871	1888	$436,939
1863	272,448	1889	510,673
1864	390,349	1890	474,990
1865	496,357	1891	451,503
1866	491,491	1892	389,965
1867	532,563	1893	381,095
1868	400,555	1894	389,338
1869	348,427	1895	453,119
1870	387,392	1896	493,568
1871	374,972	1897	562,165
1872	255,349	1898	538,590
1873	231,122	1899	617,604
1874	178,244	1900	598,553
1875	218,629	1901	546,963
1876	233,585	1902	627,357
1877	329,305	1903	527,806
1881	209,755	1907	282,686
1880	257,823	1906	252,676
1879	268,328	1905	283,353
1878	245,253	1904	214,209
1882	275,000	1908	244,799
1883	301,207	1909	210,711
1884	313,554	1910	163,891
1885	432,971	1911	160,854
1886	455,564	1912	90,638
1887	413,631	1913	44,935
		1914	63,000

Total value, $18,467,071.

Ontario—Annual Production of Gold.

Year.	Value.	Year.	Value.
1887	$6,760	1901	$244,837
1888		1902	229,828
1889		1903	188,036
1890		1904	40,000
1891	2,000	1905	91,000
1892	7,118	1906	66,193
1893	14,637	1907	66,399
1894	39,624	1908	66,389
1895	62,320	1909	32,425
1896	115,000	1910	63,849
1897	189,294	1911	42,625
1898	265,889	1912	1,788,596
1899	421,591	1913	4,543,690
1900	297,495	1914	5,546,356

Total, $14,431,931

Yukon—Annual Production of Gold

Year.	Value.	Year.	Value.
1885-1886	$100,000	1900	$22,275,000
1887	70,000	1901	18,000,000
1888	40,000	1902	14,500,000
1889	175,000	1903	12,250,000
1890	175,000	1904	10,500,000
1891	40,000	1905	7,876,000
1892	87,500	1906	5,600,000
1893	176,000	1907	3,150,000
1894	125,000	1908	3,600,000
1895	250,000	1909	3,960,000
1896	300,000	1910	4,570,362
1897	2,500,000	1911	4,851,774
1898	10,000,000	1912	5,549,296
1899	16,000,000	1913	5,843,780
		1914	5,125,396

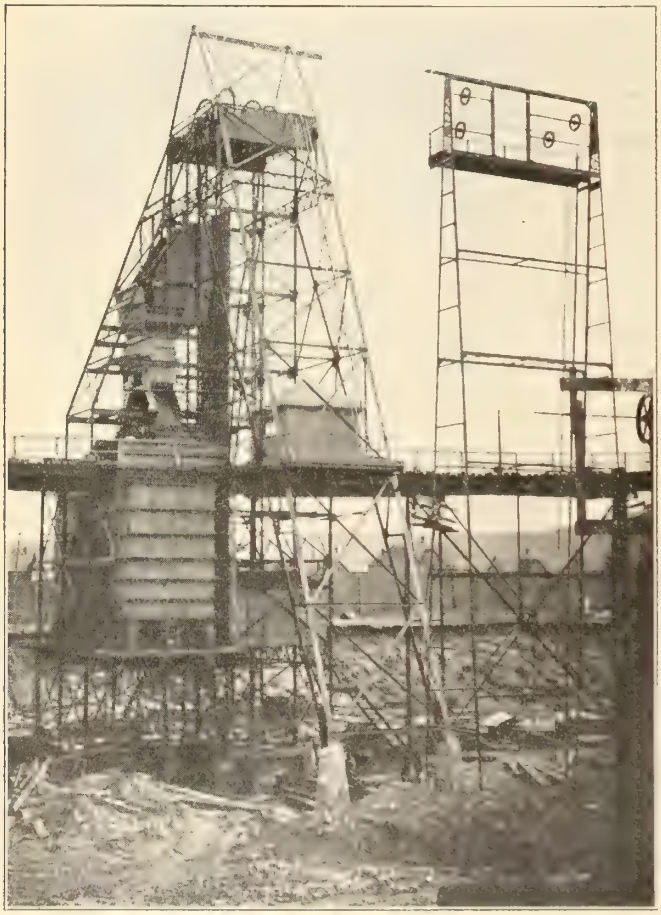
Total, $157,475,908.

SINKING A SHAFT

By P. B. McDonald.

Of all the stubborn and ticklish jobs that confront a mine management, none is capable of more kinds of unexpectedness than shaft-sinking propositions. Mine superintendents recognize, as a rule, that sinking a shaft is no easy business, and consequently put on their best miners in three shifts to get the thing done. When it is done, they heave a great sigh.

Shaft-sinking can mean sinking from surface (with possibly sand and water problems), or deepening a shaft underground, or starting a winze in some new part of the mine, or raising a shaft from underground to meet another opening from above.



Head Frame at Maas Mine. Moved aside during concreting of shaft.

Shaft-sinking in nearly any form means look out for accidents, caves, water, getting-out-of-line, and general hell-to-pay. Somehow things happen fast at shaft-sinking.

A very great advance has been effected in shaft-sinking methods of late years. With the development of big, low grade ore deposits by "permanent" shafts and expensive equipment, the tendency has been toward fewer shafts and concentration of plant, both on surface and underground. The installation of electric haulage underground makes it possible to serve a considerable area with one main hoisting shaft.

The selection of the site for a main hoisting-shaft may well be the occasion for careful study, and sometimes develops into arguments among the mine officials. Beside the railroad spur or ore-loading considerations, there is the matter of whether it is better to put the shaft down in the spot best adapted for serving tramming in the mine, or to pick the place where sinking is liable to be easiest. One iron mine at Iron River, Michigan, has its main hoisting shaft hundreds of feet back in the footwall, because to sink nearer the orebody would mean $50,000 for a shaft through quicksand. Another company put its shaft down where it wanted it, and paid the $50,000, figuring that years of tramming expense would be saved, and that, as the superintendent said, "the best way to do a thing is to do it."

The two most significant factors of late years in shaft-sinking at the 200 great mines of the Lake Superior iron and copper regions have been: concrete and the Jackhamer drill. To these might be appended the compressed air caisson for sandbags and drop-shaft work; but that is rather a special treatment not of interest except in quicksand.

The Jackhamer (a self-rotating, hammer-drill of the plugger or hold-in-your-hands type), has proved immensely popular at Lake Superior for shaft-sinking. It has four decisive advantages for this work over the customary, two-man reciprocating drill mounted on tripod or bar. They drill faster; twice the number can be used in a confined space; they can be hoisted out of the way expeditiously in a bucket when it is blasting time; they need no rigging up. Nearly all of the shaft-sinking on the Iron Ranges for the past two or three years—and there has been a good deal of it—has been accomplished by Jackhamers. In the Copper country, where vertical shafts (in which Jackhamers show up best), are as infrequent as inclined shafts at the iron mines, the Jackhamer does not excell so evidently, especially in shafts of low dip, as in the upper horizons of the Keweenaw series. (Incidentally, however, it may be remarked that Jackhamers in the copper mines have proven particularly efficacious for prospecting for copper on the sloping footwall in old or new stopes, as at Wolverine, Quincy, etc.)

Monthly records at sinking with Jackhamers on the Iron Ranges at shafts where system and celerity were unusually emphasized, have been the cause of considerable pride among the miners and bosses.

Concrete is not necessary for shaft-sinking in a hard, tough rock that is not very wet. In the broken up, sedimentary, more or less oxidized formations of the Iron Range, where water abounds in greater quantities than even the all prevalent red stain of iron, concrete for a shaft-lining is at its best. It holds back whole lakes and swamps of water. The Maas mine of the Cleveland-Cliffs Iron Co. at Negaunee, Mich., replaced a few years ago at great expense its not-very-old timber shaft through sand of over a hundred feet by a solid monolithic tube of concrete, because Teal lake nearby was slowly draining into the Maas shaft with tendencies to twist and buckle the heavy timber structure that had taken nearly superhuman efforts to sink. For lining soft, wet rock shafts, concrete can be put on in slabs or squares made on surface. Some thousand foot shafts relined in this manner have given excellent satisfaction. Or it can be put in place directly. The use of steel alone for permanent shaft timbering was considered by iron mining operators in Michigan, but concrete was preferred, since the formations are so wet.

The sinking of shafts through quicksand of a hundred or a hundred and fifty feet, as has been done not only at Minnesota and Michigan iron mines, but also at coal mines in the central states, is the most precarious phase of sinking. No one who has not experienced the terrific consequences of such an undertaking can imagine the difficulties, dangers and hopelessness of trying by ordinary methods to make progress in an ocean of quicksand, where the closely timbered shaft, in spite of sheet iron, straw and braces flops out of line, twists around, or drowns out in a trice. Navigating submarines or flying in aeroplanes is nothing compared to handling quicksand. The best solution of the worst problems in sand-shafts on the Iron Ranges was the dozen concrete drop-shafts, sunk by the Foundation Company on contract, using a compressor air caisson across the shaft, in which more or less desperate characters known as sandboys (white men and negroes who follow such work around) pick and shoveled in air up to 50 lb. pressure per square inch. The contract price for these shafts was not uncommonly high, $500 per foot. Built several feet thick of reinforced concrete; with circular cross-section, but sometimes with rectangular interior; some of them

Maas Iron Mine, Negaunee, Mich.

with walls tapering in thickness toward the top, these monolithic tubes of 100 or 150 ft. depth were sealed water-tight to bedrock without pumping a gallon of water. Enormous quantities of concrete and a considerable weight of reinforcing steel were used, as permanency was desired, and, too, the greater weight forced the cutting-edge down to better advantage. The cost of cement and steel was a large item. The Rogers shaft at Iron River described by me in my article in the M. & S. Press of December 30, 1911, is 29 ft. in outside diameter with a rectangular interior of 16½ x 11 ft., so that the walls vary around the circle from 3 ft. to 7 ft. in thickness.

Some queer complications arose at two or three of these sand-shaft jobs sunk on contract, and strange things were done before the shafts were finally sealed to rock.

A not unpleasant surprise was occasioned by M. A. Hanna & Co. in sinking a shaft at Crystal Falls, Mich. Having arranged for pumping a lot of water, with ample pumps, boilers, coal, etc., at the temporary plant which served for sinking, scarcely any water was found as the work went ahead. It had been feared that, as there were no other mines in the immediate vicinity, and consequently the water-level had not been artificially lowered, the sand and water customary in the district would give trouble.

At the Susquehanna mine at Hibbing, Minn., where it was first attempted to sink a shaft, several failures were made, due to the amount of water and quicksand encountered. Later, Captain Thomas Caddy was engaged at a comfortable salary to put into use his experience gained at the wet, old Penobscot mine nearby, and he got the shaft down. He tried sinking two shafts at once, so that pumping could be carried out to better advantage, and he forced the short drop-section of the main shaft down through occasional hard streaks of sand and gravel by jack-screws. This was a timber-lined shaft, but with a steel cutting edge on the drop-section. Incidentally, when the shaft got deeper, a shift boss was instantly killed by someone accidentally dropping a jack-screw from surface on his head.

The Rolling Mill No. 2 shaft in the Negaunee basin, Michigan, was raised 620 ft. from underground in five months, through jasper and schist to surface in one vertical raise with no levels or stops. Later the same stoper drills were used to enlarge the shaft from 8 x 8 to 12 x 14, drilling inclined holes from below to trim off the shoulder, the enlarging progressing downwards.

At a shaft of the Tod-Stambaugh Co., near Hibbing, sunk by the Foundation Company on contract, extraordinary difficulty was had in forcing the concrete tube to solid bedrock through mixed hard-pan and sand. After weeks of scarcely any progress, a great ball of concrete was made and rolled on the drop-shaft, and with the air pressure of the caisson temporarily removed to get rid of its buoyant effect of several hundred tons, a few inches at a time was gained.

A somewhat similar difficulty occurred at the Rogers shaft at Iron River, where 125 ft. was accomplished through sand in 90 days, being an average of nearly 1.4 ft. per day, which was considered excellent. But to sink the next 15 ft. there required 30 days, an average of 2 inches per day as the result of the labors of 50 men, working expensive shaft shifts in the compressed air of the caisson.

At the North Lake mines of the Cleveland-Cliffs Iron Co. near Ishpeming, pigs of iron were used for weights in forcing the concrete drop-shafts through hard streaks.

In the sinking of the first timber-lined shaft at the Maas mine of the same company at Negaunee, at most quicksand was pumped that a big, bowl-shaped depression formed around the shaft, which stuck up like a smoke stack in the great hole.

One company operating on the Mesaba Range tried sinking a timber-lined shaft through 200 ft. of sand, to reach a big orebody proved by diamond-drilling and was obliged to [illegible] it mostly in bedrock.

Several unusual details developed during the sinking of concrete drop-shafts by the caisson method: The holding up of one side of the shaft by a boulder under the cutting-edge or shoe, causing the huge concrete tube to tilt out of plumb; tearing of the steel shoe to a distorted wreck by the hard layers it passed through; men with the "bends"; controversies between the mining company and the contractors; the difficulty of inspecting the work; when is "bedrock" too soft and broken up to be "bedrock," or is it hardpan?; leakage of the compressed air out through the soil.

Illustrative of the recognized capability of Lake Superior miners at shaft-sinking is the recent sending of fifty picked miners gathered at Crystal Falls, Michigan, to sink a 1,200-ft. shaft for the Orkla Mining Co. of Christiania, Norway. The contract was awarded by the Norwegian organization to the E. J. Longyear Co. of Minneapolis, partially in order to gain a knowledge of American sinking methods and American machinery, in spite of the fact that European practice in tunneling is reputed to be superior to American methods. The shaft is to be sunk in less than a year's time, and the miners will be paid a bonus for each month's work that is greater than 65 ft. Naturally the first several months' progress will be more rapid than later when depth, water, and darkness will slacken speed. The rock is said to be very hard, but, of course, hard ground if firm and homogeneous is to be preferred to some broken up, softer formations.

GRANBY CONSOLIDATED.

Granby Consolidated Mining, Smelting and Power Co. produced 26,705,928 lb. of copper in its fiscal year ended June 30. Of this amount 10,005,278 lb. came from the Grand Forks smelter and 16,700,650 lb. from the new Hidden Creek smelter at Anyox. From both properties precious metals recoveries totaled 415,806 oz. of silver and 32,126 oz. of gold.

The annual meeting of stockholders will be held in October and not until that time will the annual report be available. Notwithstanding the comparatively low cost at which the new Hidden Creek property has been producing copper, there were other factors, including the three months' shutdown last fall at Grand Forks, to keep total costs up to about 10½ cents a lb.

In June the Hidden Creek smelter made a record production of 2,053,027 lb. of copper against 2,021,717 lb. in the preceding month. The output at the old smelter at Grand Forks was 1,573,902 lb. comparing with 1,662,398 lb. in May.

Results of the past year's operations were as follows:

	Grand Forks.	Anyox.	Total.
Copper, lb.	10,005,278	16,700,650	26,705,928
Silver, oz.	179,205	236,601	415,806
Gold, oz.	24,998	7,128	32,126

Granby now has its smelting capacity in full swing as the fourth furnace at Hidden Creek has just been blown in. Production for the year beginning July 1 should exceed all that has gone before and costs at Hidden Creek should bring the average for the entire property down to a fair level if permitted steady operations. At the height of winter the Hidden Creek smelter will doubtless have to close for a few weeks, but this the management expects.

The Midas mine in Alaska has not started production and no definite plans have apparently been made in this direction.

PERSISTENCE OF ORE IN DEPTH*

By G. R. Mickle.

The paper on "Persistence of Ore in Depth" has evidently stimulated a great deal of discussion. It appeals to me as most useful and important, and without discussing the facts presented or the conclusions arrived at, I wish particularly to refer to the mode of reasoning followed. The method used is necessarily influenced by the different nature of the things under observation, but it is similar to that employed in determining the "Expectation of Life" by insurance companies. We are all familiar with the certainty and security of the life insurance business. Two factors contribute to this (1) the existence of many hundreds of thousands of observations on the length of life of the same kind of thing, i.e., healthy males who have been subjected to standard tests; this establishes the "expectation" for the individual, and (2) the fact that insurance companies take risks of comparatively small amounts on thousands of individuals, and not very large amounts on a single individual or small number of individuals.

To determine the "expectation" the thing that is relied upon is the work of the actuary of the insurance company. Physicians, physiologists and bio-chemists might estimate the length of life from their profound knowledge of the human body and the changes that take place in it, but the company that transacted business on their calculations would probably come to grief. At any rate, the results of many years of experience have proved that the actuary's work is reliable.

In the case of mining, the thing we wish to determine frequently is the "expectation" of any mine, using this term in the technical sense defined in works dealing with this subject. Thus, "the expectation from any event is obtained by multiplying the sum to be realized on the event happening by the chance that the event will happen."

It is necessary to ascertain the chance of success or "the chance that the event will happen," and in estimating this a knowledge of the history of similar things seems indispensable. But this is the very kind of knowledge which is not available to any adequate extent.

In any given mining district (for example, one containing gold-bearing quartz veins), in order to find out what proportion of the veins that have been tested are capable of being worked profitably would require probably months of constant investigation on the part of some one who had access to all the workings. This, if done, is very seldom published. It is obvious that any extensive information on such points as this—and it would not be of much value unless it were extensive—would require the co-operation of a great many. The examination would have to be made in some standard manner, that is, as far as determining certain specific things, just as the medical examiners for life insurance subject the applicant to standard tests.

It is clear we can never reduce the business of mining, involving as it does first the determination of the "expectation" of any given vein, and then the taking of the risk, to the same degree of certainty as life insurance, as we can never expect to have as many observations to fix the first, or sufficient capital to embark on thousands of enterprises. Moreover, the things themselves involved in the two cases vary between wider limits. The same degree of certainty is

*A contribution to the discussion of a paper presented before the Institution of Mining and Metallurgy, London.

not necessary, but we should be able greatly to improve the present state of affairs.

Mr. Rickard's paper appears to be a most important and valuable contribution in this direction and, I think, more likely to lead to a useful result than the voluminous discussions of the way ore has been formed and the deductions therefrom which are so dear to geologists. According to the theories of ore deposition generally accepted, the different elements or compounds which constitute ore are dissolved in some medium, transported in some way, and precipitated again, the solubility and precipitation are influenced by temperature, pressure and sometimes minute changes in composition, and other things; that is, the fact whether ore exists in any place depends on a combination of a number of events and, therefore, there must be a great number of ways in which the events might happen and, consequently, it seems unlikely we can correctly predict what has happened below the crust of the earth.

If we consider for a moment what takes place when we proceed in the opposite direction, viz.: vertically upwards, we see how theories have failed. It has formerly been assumed that with an ascent vertically upwards the barometric pressure and also the temperature would drop till finally at the limits of the atmosphere where the air pressure would vanish, the temperature would be zero (absolute) (—) that is—459° F. Within the last twenty years, however, meteorological observatories in many parts of the world have been sending out small balloons fitted with barometers and thermometers to great altitudes. This has proved that at an elevation of seven miles, more or less, dependent on the latitude, a layer of constant low temperature—50° F. to 130° is entered. This is called the stratosphere. As the balloon ascends through the stratosphere the temperature rises instead of dropping as it should, and this continues to an elevation of about 19 miles, beyond which there are no observations. Moreover, the stratosphere at the equator is some 30° colder than in middle latitudes, and over Canada, the stratosphere has a lower temperature in summer than in winter. We see then that in the case of the temperature of the air above us, although as far as known previously this depended on one thing only and nothing could interfere with it, the theory fails altogether. How much more likely is the theory to fail when the result admittedly depends upon a number of factors?

THE BRITISH COAL MINERS' PART IN THE WAR

As the outcome of a recommendation made in the report of the Departmental Committee on Coal Mining Organization, one of the most remarkable gatherings in the industrial history of the United Kingdom was held on Thursday, July 29th, at the London Opera House, Kingsway. The Home Secretary, Sir John Simon, presided. The meeting took the form of a conference of representatives of coal owners and miners from every coal field in the country, convened by the Government at which both were about [illegible] present. The Government Departments and coal trade organizations represented included the Home Office, the Board of Trade, the Board of Education, the National Insurance Commission, the Ministry of Munitions, the Coal Mining Organization Committee, the Mining Association of Great Britain, the Miners' Federation of Great Britain, and the English, Scottish and Welsh Conciliation Boards. The proceedings were very enthusiastic throughout. After speeches by Cabinet Ministers, a resolution declaring that "every effort should be made to secure the greatest possible output of coal," proposed by Mr. Robert Smillie, president of the Miners' Federation of Great Britain, and seconded by Mr. A. F. Pease, acting president of the Mining Association of Great Britain, was put to the meeting and carried unanimously.

Sir John Simon said the conference was called together by the Government and those connected with the great coal mining industry of the United Kingdom. Representatives of every coal field and, he believed, of nearly every miners' lodge in the whole country, were present. The Mining Association of Great Britain and the Miners' Federation were both represented, and that great assembly proved how united the coal mining industry was in the crisis they were prepared to face. The object of the meeting arose from a very remarkable and interesting report made by the Coal Mining Organization Committee, appointed by the Home Office and presided over by Sir Richard Redmayne. The committee, which contained an equal number of representatives of coal owners and miners, arrived at an absolutely unanimous report, and made a series of recommendations as to how the output of coal could best be maintained during the present emergency. It must be done by voluntary co-operation. That was the spirit in which the committee had reported; it was in that spirit that the Government had called the meeting together and counted upon them to promote the success of its object.

The mining industry had responded splendidly to the appeal for recruits. Whole regiments had been recruited from the colliery districts up and down the land. He had been assured by soldiers the most eminent that the miners carried to their work in the firing line the bravery and determination that actuated the industry throughout the country. In at least one military unit practically every private was a pitman, every officer and non-commissioned officer was connected with a colliery, and the commanding officer was one of H.M. inspectors of mines. The miners had given [illegible] Army [illegible] of a million men.

The Government and the country looked to the coal owners to see to it that when these brave men came [illegible] to resume their ordinary occupations.

[illegible] and plans all on the coal mining [illegible] to secure that the necessary supplies were forthcoming. They had [illegible] [illegible] men. Those who were left and who were employed in the coal mines [illegible] and [illegible] [illegible] [illegible]

it ought to be possible to recover some part of that shortage.

They would remember that Lord Kitchener had asked the industry to shorten the Easter holidays. What happened? Eight hundred thousand more tons of coal were raised. It might be truly said that the pits were only open a certain number of days, and the men might work only a certain number of hours, and that it was difficult to see, under such conditions, how a greater output could be secured. But they were met together to consider within what limits those conditions might be usefully modified for the period of the war, and he asked the owners to open their pits, and the miners to work on every day they possibly could. They would not suppose that the country did not understand that those who spent the working hours delving in the bowels of the earth in darkness and danger, expected to pause in their labors from time to time. But at such a time as the present there were no holidays for anybody, and he was sure the coal mining industry would see how they could help the Government in that regard.

The Eight Hours Act, though passed in times of peace, and in response to an overwhelming demand, contained a section which provided that in the event of war or imminent national danger or great emergency, the operation of the Act might be suspended by order-in-Council to such extent and for such period as might be named in the order. The Government, however, were not going to play tricks with that Act of Parliament without consulting them. He hoped that masters and men in every area likely to be affected would consult together to see what suggestions they felt able to make to the Government—whether a temporary modification of this or that regulation—to increase the output of coal to the maximum quantity possible. In the course of long years of effort the miners had established rules, customs and practices designed to protect their labor. Nothing that he or anyone said was intended to belittle the importance of those rules, or to indicate that they could be abandoned or watered down. But there were adjustments and modifications which might be made in them during the period of the war. In return he pledged the honor of the Cabinet, the Government, Parliament and the country that any relaxation in those rules and practices which, for national purposes, the miners made now, should be restored to them without alteration or modification, the moment the danger was past.

The Government relied upon the coal owners similarly to modify their established rules and practices, and to do everything they could in co-operation with the men to see that suggestions calculated to increase the output and to assist the nation during the crisis, should be favorably received, carefully weighed, and generously accepted in every possible case. In that way, they were confident that great additions could be made to the output of coal in the coming months. One class of regulations, however, would never be modified; those designed to secure safety in the mines. Nothing they were asking to be done ought in any way to modify or water down regulations made for the common good, not merely to protect the miners who might be injured, but the lives and limbs of all his fellows in the mine.

"Our country stands at this time in an emergency, and is faced by a danger which it is impossible to overstate. If there is one feature of the coal mining industry which strikes the imagination of every man who studies it, it is the instant response which everyone connected with that industry habitually gives if some great and overwhelming disaster overtakes the mine. When the news spreads of some terrible explosion, who is there, miner or mine manager, who holds back when the call goes out for a rescue party? Is the appeal ever made in vain in any mining district in the land? Gentlemen, nearly a year ago the greatest explosion that ever took place in the history of the world occurred in Europe. It was not the result of the secret workings of nature; it was not even due to the folly or the carelessness of some man. It was deliberately perpetrated. It was long planned. The German Emperor set fire a year ago to the mine, and we are calling for a rescue party. That explosion convulsed a continent. It has devastated thousands of square miles of fruitful territory. It has desolated tens of thousands of homes. And now we appeal to the mining industry of Great Britain to come and help in this work of rescue. For we are determined that this devastating fire shall be quenched, that peace and order shall be restored, that the dangers that threaten the freedom and the life of all who care for a free life, shall be removed, and that this terrible calamity, shaking as it does to their foundations the seats of the mighty and the humblest of homes, shall never, by dint of our efforts, and by the help of Heaven, be allowed to recur to curse the earth. That is the appeal we make for our mining rescue party, and we are very sure that the appeal will not be made in vain."—Colliery Guardian.

CROWN RESERVE.

Montreal, Aug. 23.

Directors of the Crown Reserve Mining Company, Ltd., at a meeting held here to-day, decided, for the time being, to discontinue dividends. This course of action is stated by the directors to be due to the disappointing results in draining Kerr lake and also to the demoralized condition of the silver market. The following circular will be mailed to shareholders to-day:

"Your directors take this occasion to advise you that the drainage of Kerr lake and the removal of the mud and clay since the first of January, 1916, has not uncovered up to the present any large deposits of ore in the bed of the lake. Promising veins of ore of good value have been discovered on the Kerr Lake property, immediately adjoining the Crown Reserve line, and we trust that ultimately some discoveries will be made on the property.

"The operation of the mine during the last six months has been almost entirely in low grade ore, and the cost of milling and marketing the same has left only a very small margin of profit.

"The fall in the price of silver has also considerably reduced the profit from the sale of the ore produced, and your directors feel that unless the market for silver, which has never been at such a low point, has recovered, they will be acting in the best interests of the shareholders at large by retaining the ore and bullion, discontinuing the dividends, and conserving all the revenue of the company, which includes the dividends received from the Porcupine Crown Mines, Ltd., and acquire other properties when a suitable opportunity occurs."

MINERS' UNIONS IN CANADA*

(Continued from last issue.)

Western Federation of Miners.

As with the coal miners, various forms of organization have existed for many years among the metalliferous miners on the North American continent. For some time these bodies were independent or purely local concerns, the operations being confined to some particular locality. As early as 1867 a miners' union was organized at Virginia City, Nevada, and has maintained a continuous existence, affiliating with the Western Federation of Miners some years after that organization was formed. In January, 1879, in Leadville, Col., the miners formed a union, which was publicly known as the Miners' Co-operative Union, but was in reality a Knights of Labor Assembly working in secret. This union, though having largely increased its membership in the early years of its existence, appears to have lost its identity, for it is recorded that in May, 1885, a miners' union, with 85 charter members, was organized in Leadville. In 1887, this union, with a membership of about 600, became identified with the Knights of Labor. There was no affiliation between the miners' unions which had been formed in the various mining camps, not even an exchange of working cards. This situation continued for a number of years until a convention was held in Butte, Montana, on May 14 and 15, 1893, at which were laid the foundations of the Western Federation of Miners. The beginning was small, fourteen unions, with a combined membership of approximately 2,500, forming the nucleus of the new organization. At the outset the policy of the Western Federation was to include in its membership coal miners as well as metalliferous miners, and this course was pursued until, in 1905, an arrangement was made between the United Mine Workers and the Western Federation of Miners whereby a division of jurisdiction was effected, the former confining its activities to the interests of the coal industry, and the Western Federation to metalliferous miners. In 1905 an interchange of transfer cards was also arranged between these two organizations.

The Constitution of the Federation.—The preamble to the constitution of the Western Federation of Miners, as contained in the issue of 1912, is as follows:

"1. We hold that there is a class struggle in society, and that this struggle is caused by economic conditions.

"2. We affirm the economic conditions of the producer to be that he is exploited of the wealth which he produces, being allowed to retain barely sufficient for his elementary necessities.

"3. We hold that the class struggle will continue until the producer is recognized as the sole master of his product.

"4. We assert that the working class, and it alone, can and must achieve its own emancipation.

"5. We hold, finally, that an industrial union and the concerted political action of all wage workers is the only method of attaining this end.

"6. Therefore, we, the wage slaves employed in and around the mines, mills, smelters, tunnels, open pits and open cuts, have associated in the Western Federation of Miners."

The following is a resume of the articles of the constitution as laid down for the governance of the organization:

The federation is composed of persons working in and around mines, mills, smelters, tunnels, open pits and open cuts. Among other objects it is the aim of the federation to increase the wages and improve the conditions of employment of the members by legislation, conciliation, joint agreements or strikes. Local unions are composed of twenty or more members. These units may form district or state unions, the same to be chartered by the federation. District unions are subordinate to the federation, but are a higher authority than the local unions in its jurisdiction. The conventions of the federation are held biennially on the third Monday in July, and each union is entitled to one delegate for 100 members or less, and one for each additional 100 members or majority fraction thereof, but no delegate is entitled to more than five votes. Ladies' auxiliaries of the Western Federation are entitled to one delegate with one vote. The pay of each delegate is not less than $5 per day, which is paid by the local union represented. The transportation expenses of one delegate from each local in good standing are paid by the federation, as is also the transportation of one delegate from each ladies' auxiliary. Unions electing more than one delegate pay the whole expenses of delegates in excess of that number.

The officers of the federation consist of a president, vice-president, secretary-treasurer and four other executive board members. These officers are elected biennially by referendum vote. Provision is made for the recall of any official on petition of not less than 10 per cent. of the membership in good standing, representing not less than ten local branches. Among other duties of the president, he has the power to appoint, with the approval of the executive board, such organizers as conditions justify. Organizers so appointed are entitled to $100 per month and transportation expenses. The president is required to visit each district once a year, and may convene the executive board when necessary; or he may, with the approval of the executive board, call an extra convention of the federation. With the concurrence of the executive board, the president may sell, transfer or encumber in any manner and to any extent any and all real and personal property, except the funds of the federation. Also, with the consent of the executive board, the president may revoke the charter of any local union or penalize it for violation of the constitution or by-laws, or for proven treachery to the principles of the federation. With the approval of the executive board, the president has the power to appoint one or more auditors, whose duty it is to audit the accounts of all unions, and to collect, for the use of the federation, such statistics as may be determined by the president. For his services the president is entitled to $5 per day and all necessary transportation and other expenses. The secretary-treasurer, whose duties include full charge of all the funds and property of the federation, receives $150 per month. The executive board members, constitute the board of arbitration and conciliation, and between conventions have full power to direct the workings of the federation. Each executive board member is also an organizer, and has power to investigate the conditions of local unions, and to report to the president. In case of trouble arising at the jurisdiction of a union, a member of the executive board

*Extracts from the Fourth Annual Report of the Department of Labor, Ottawa.

is authorized to take full charge in the direction of affairs or negotiations until the arrival of the president. The members of the executive board receive $4 per day and legitimate expenses. The revenue of the federation is derived from charter fees ($10) and a per capita tax of 25 cents per month and, in case of emergency, by such assessments as in the judgment of the executive board or convention may be necessary. The constitution provides for the publication of a weekly official journal, the pages of which are open to all members of the organization for the discussion of social, industrial, economic and political questions, etc., and must at all times advocate the principles of what is termed "industrial unionism."

Strikes and Adjustments.—Under the article pertaining to strikes and adjustments, local unions are enjoined from entering upon a strike unless ordered by two-thirds of the votes cast upon the question, such vote to be decided by referendum, of which three days' notice is to be posted, and vote to be taken by ballot, polls to be open for not less than eight hours. No referendum vote on a strike can be taken until after having received the approval of the executive board. In case of a union or unions being on strike, regularly ordered, and if in the opinion of the president and executive board it is necessary to call out any other union or unions in order to carry the strike to a successful termination, they have full power to do so. When a strike has been approved, the president is empowered to appoint, with the consent of the executive board, a representative to take charge of the funds furnished by the federation for the relief of members involved in a strike or lockout. The representative is required to make complete itemized returns of all receipts and expenditures to the executive board. Local unions or groups of local unions are empowered to enter into wage agreements for a specified time, provided such agreements have the approval of the executive board. Negotiations for such agreements must be made between the representatives of the local or locals affected and the employers, with at least one member of the executive board or representative of the general organization being present.

Reinstatement of Strike Breakers.—Methods for dealing with offences against the federation, its officers or members by members are outlined in article XI. One section is as follows:

"Any one acting as a strike breaker or scab during a strike in the jurisdiction of the Western Federation of Miners, who professes to have seen the error in his ways, may be placed on probation by the local union involved, or by any local union in whose jurisdiction he may be employed when such charges are preferred against him, provided the local involved grants permission; provided, that this shall in no way apply to any man who has been a deputy sheriff or gun-man in the employ of any corporation. Such men shall remain on probation until such time as the local union, in whose jurisdiction he is working out his probation, shall declare his offence expiated in full by good work for the cause."

When a member becomes a foreman or shift boss, or assumes a position that cannot be termed as part of a mining industry, he loses his active connection with the local union, but may continue as a beneficiary member or may be granted a withdrawal card.

The constitution provides for the initiative and referendum in all legislative questions of the federation, and the executive board has power to submit to a referendum vote any question of an urgent nature.

As with the constitution of the United Mine Workers, the federation provides for the issuance of transfer cards and also for the acceptance of similar cards from members of any chartered labor organization, subject to the rules governing the members of the federation.

From 1893 onward the federation grew in strength and influence, and not only concerned itself with mining difficulties, but championed the cause of workingmen generally.

Officers of the Federation.

The following is the full list of officers of the Western Federation of Miners: President, Chas. H. Moyer, Rooms 503-11, Denham Building, Denver, Colo.; vice-president, C. E. Mahoney, Rooms 503-11, Denham Building, Denver, Colo.; secretary-treasurer, Ernest Mills, Rooms 503-11, Denham Building, Denver Colo.; editor Miners' Magazine, John M. O'Neill, Rooms 503-11, Denham Building, Denver, Colo.; Executive Board, J. C. Lowney, 450 North Idaho street, Butte, Montana; Yanco Terzich, 503-11, Denham Building, Denver, Colo.; William Davidson, New Denver, B.C.; Guy Miller, Box 300, Joplin, Missouri.

The Coeur d'Alene and Other Strikes.—In 1894 the organization was involved in a strike in the mining district of Cripple Creek, Colo. This dispute developed into a most bitter struggle in which assaults and bloodshed occurred. In the spring of 1899 the miners at the Bunker Hill mine in Wardner, who had only recently organized, made a demand for the same rate of wages as that paid in the other mines in the district. The demand was refused, and a strike occurred on April 24, 1899. On April 29 the concentrator at Bunker Hill mine was blown up, by whom it was never established, but the strikers were accused, and riots ensued. Federal troops were sent to the strike zone and martial law was declared. Some 1,600 arrests were made, and the men were imprisoned in sheds (termed at the time "bull pens") without any conveniences. Of these about twenty were tried for a stated offence and eight were convicted.

The trouble in the Coeur d'Alene mining district of Idaho continued for some time, and was renewed with considerable violence in 1902. The whole strike situation was made the subject of an inquiry by a commission appointed by the United States Senate. Martial law having been twice declared in Coeur d'Alene district, a proclamation was issued by Governor Steunenburg, jointly with the general commanding the troops, forbidding the employment of men who did not hold a permit from the State authorities. The holder of such permit renounced all allegiance to the miners' union and promised not to seek membership in any other society. The actions and utterances of Frank Steunenburg, the Governor of Idaho at the time of the dispute, created bitter resentment on the part of the members of the federation, who applied to him the epithet of "Bull-pen Steunenburg." On the night of December 30, 1905, ex-Governor Steunenburg was assassinated. A few months later Chas. H. Moyer, president of the federation, and Wm. D. Haywood secretary, and Geo. Pittibone, a former member, were charged with the crime. At the trials, which were delayed eighteen months after the arrests were made, the accused were acquitted. Vincent St. John, president of Burke Miners' Union, was also arrested in February, 1906, on the charge of being implicated in the Steunenburg murder, but there being no evidence against him he was acquitted.

The trial of the officers of the federation attracted widespread interest, particularly amongst the labor organizations, many of which held meetings protesting against the manner in which the accused had been arrested, and also against the delay in the holding of the trials. Assessments for the defence of the officers were levied on members of the federation, and contributions were received from other labor organizations.

The Federation and the I. W. W.—On June 27, 1905, with a number of delegates from other bodies, the chief officers of the Western Federation of Miners were instrumental in organizing the Industrial Workers of the World, a frankly revolutionary organization. Mr. W. D. Haywood, the secretary of the miners, acted as chairman of the organization meeting. The Western Federation of Miners, with 27,000 members, became enrolled as a part of the new organization, and Mr. Chas. Moyer, the president of the federation, was elected as a member of the executive board of the new organization. The action of the Federation of Miners in taking a prominent part in the formation of the Industrial Workers was condemned by the American Federation of Labor, and unions affiliated with that body were requested not to assist by any further contributions the eight-hour-day campaign of the Federation of Miners. The second convention of the I. W. W. was held in 1906. The legality of some of the acts of this convention was questioned by certain of the officers of the Western Federation of Miners, and the question of sustaining the action of the convention was submitted to a referendum vote of the federation members. The vote was overwhelmingly against approving the acts of the convention, and in addition a number of unions opposed the payment of any further per capita tax. The executive board, therefore, refused to pay any further tax to the I. W. W. until a better understanding was secured. At the 15th annual convention, held in June, 1907, the federation withdrew from what was termed the Trautman faction of the I. W. W. (Trautman was the secretary of the organization), and appointed a committee of seven, including W. D. Haywood and Chas. H. Moyer, to aid in launching a re-organized Industrial Workers of the World. This committee, however, was apparently unable to carry out the objects for which it was appointed.

Agreement with U. M. W. and Reaffiliation with A. F. of L.—At the seventeenth annual convention in July, 1909, a committee was appointed to arrange a conference of labor organizations in the mining industry with a view to bringing about a more compact organization. Subsequently a conference was held with representatives of the United Mine Workers, and as a result an agreement between the two organizations was reached, embracing the following clauses: (1) That at some time in the future there shall be a complete solidification of the W. F. of M. and the U. M. W.; (2) that the present arrangement of a mutual exchange of transfer cards be continued; (3) co-operation of organizers in organizing the coal miners and metal miners; (4) that the Western Federation of Miners affiliate with the American Federation of Labor; (5) that a mining department under the jurisdiction of the A. F. of L. be formed. The agreement was submitted to a referendum vote of the federation and endorsed by an overwhelming majority. On June 22, 1910, application for charter of affiliation was made to the American Federation of Labor, the application being granted on May 9, 1911. The Federation of Miners was previously affiliated with the A. F. of L., a charter being secured in 1896. This affiliation was severed in 1898, and the Miners affiliated with the Western Labor Union, the affiliation continuing until the latter body dissolved in 1905.

Internal Troubles.—In addition to the conflicts which have been brought about by the demands for better working conditions for its members, the federation has been involved in a serious internal difficulty in Butte, Montana, where the largest local union of the federation, with approximately 7,000 members, has existed for the past thirty-six years. There appears to be a multitude of reasons assigned for the disintegration of the union, but one which stands out prominently is, that the Industrial Workers of the World, with which organization the federation was at one time identified, is responsible for the dissension. In May, 1913, the I. W. W. advertised in Salt Lake, Utah, that miners and muckers were wanted in Butte, although it was stated by the federation officials that such was not the case. From this time on the affairs of Butte local union become worse, charges and counter charges were made from time to time. On June 13, 1914, an attempt was made to wreck the Miners' Hall in Butte. The safe was taken out on a flat and dynamited, the records destroyed and the money taken. Some days later President Moyer went to Butte to investigate the cause of dissension and endeavor to bring about harmony. On June 23 Mr. Moyer attended a regular meeting of the union and made certain propositions to the local, and while he was speaking a crowd of dissentients attacked the hall with dynamite and demolished it. On June 21 an independent union of miners was formed in Butte, fathered, it was stated, by the I. W. W., more than 600 men who were brought to the locality joining the union organization. On August 8 a committee of the federation visited Butte to try and make arrangements for a new election of officers, the former having resigned in accordance with President Moyer's suggestion when he visited the union. With the coming of the committee the new union became active and made demands on the mining companies to discriminate against the members of the W. F. of M. and to force all men working in the mines to join the new independent union under threat of deportation. The State militia was subsequently ordered to the district to prevent disorder. Later, while the militia [illegible] the locality, the dualists proposed a demonstration, but the newly-appointed sheriff refused to allow any [illegible] tration.

When the federation was organized in 1893 the membership was about 2,500. During the next ten years the membership had reached 50,000. At the close of 1911 the figure was reported at 65,150; in 1912, 61,000; in 1913, 67,450; and in 1914 there were 250 local branches with a membership of 65,400. Of these twenty [illegible] local branches with a combined membership of 4,915, are in Canada.

Entry into Canada.—Previous to the coming of the Western Federation of Miners to Canada a number of local unions [illegible] were in existence in the Dominion, both coal and metalliferous. In most instances these unions soon became identified with the Western Federation, the first Canadian local to affiliate being the Rossland, B.C., Miners' Union. This occurred on July 10, 1895; other affiliations [illegible] were [illegible] in 1900, and, on December 17, 1900, [illegible] were admitted to [illegible] Union No. 6. The following year [illegible] successful in organizing a number of [illegible]

branches, composed of coal miners in eastern British Columbia, and on November 25, 1902, District Union No. 7 was formed, with headquarters in Fernie. This district body only existed for one year, dissolving in November, 1903, when District Union No. 18 of the United Mine Workers of America was formed. All the locals that had formerly comprised District Union No. 7 of the federation went over in a body to the United Mine Workers. In 1906 the Western Federation entered the province of Ontario, the Cobalt miners forming local union No. 146 on March 24 of that year.

Federation Strikes in Canada.—The first strike in Canada under the auspices of the federation, according to records available, was occasioned by the refusal of the mine operators at Rossland, B.C., to grant an increase in wages. The strike occurred on July 11, 1901, and involved about 1,000 men. After the strike had been in existence for three months an effort was made, through application of the union, to settle the dispute under the Conciliation Act. The result was unsuccessful, and the strike continued. On January, 23, 1902, it was reported that the strike at one of the mines had been declared off, but no understanding had been reached with the other companies concerned. It was stated that the demand of the men had not been granted, but the terms of settlement were not made public.

On February 11, 1903, the Federation was concerned in a strike of coal miners in the Crow's Nest Pass coal region, which was under the jurisdiction of the District Union No. 7, and involved 1,500 men. The strike was the outcome of a refusal of the company to meet a committee of the newly formed district union. This strike was made the subject of investigation by the Dominion Government whose officer endeavored to effect a settlement, but without success. On March 1 the British Columbia Mining Association appointed a committee to act as a conciliation board with a view to bringing about a settlement. As a result, an agreement was reached which granted recognition of the union, an increase of wages in some classes of work in certain mines, and a definite arrangement governing conditions of employment. The contract was to be effective for three years from April 1, 1903. On March 28 the terms of settlement were finally accepted by both parties, and work resumed.

In March, 1903, the local union of coal miners of the federation at Ladysmith, B.C., was involved in a strike, 700 men being affected. A number of employees had been discharged, and the men believing that this action on the part of the company was owing to the fact that they had recently formed themselves into a branch of the federation, led to the strike. In July, the strikers, not having received the aid they had expected from the federation, returned to work under the old conditions.

On August 12, 1903, the members of Van Anda local, to the number of 215, went on strike for increase of wages and reduction of hours. This demand was subsequently withdrawn and a request for recognition of the union substituted. On September 2 the strike was declared off, the company having agreed to recognize the union and to discuss any grievances in the future with a committee of the union.

No strikes of importance occurred during the years 1904 and 1905, and only one took place in 1906, in which the federation was concerned. This dispute took place at Greenwood, B.C., on November, 21, owing to the refusal of the mining company to grant a demand for a minimum wage of $3, some 350 men being involved. On November 29 the demand was granted and the men returned to work on the following day.

The first strike of metalliferous miners in the Province of Ontario occurred on July 8, 1907, when the members of Cobalt Miners' Union No. 146, to the number of approximately 3,000, ceased working, owing to a disagreement as to wages and working conditions. Negotiations for a settlement were subsequently carried on, in which the Department of Labor took part. A compromise agreement was later reached with a number of the mining companies in which the miners secured some concessions. Some other companies held out, but by the end of September normal conditions had been restored in the mining district.

During the years 1908 and 1909 the federation had no strikes in Canada. On April 19, 1910, a strike was declared by local union No. 22, at Greenwood, B.C., owing to the refusal of the copper company at that place to employ none but members of the Western Federation of Miners. On May 11 the strike was declared off, the men having failed in their demand, and the 350 men affected resumed work. Prior to the strike the matters in dispute had been referred to a board of conciliation and investigation under the Industrial Disputes Investigation Act, but the award of the board was against the demands of the union.

During 1912 three strikes occurred in the Cobalt silver mining district. The first took place on April 28, on account of the discharge of two employees by a mining company for alleged intimidation of fellow workmen. On April 30, after two days' idleness, the strike was declared off, and the 189 men affected returned to work, with the exception of the two who had been dismissed. The second strike, which involved 225 men, took place on October 19, and was caused by the refusal of the company to reduce the working hours from ten to nine per day. On November 4 work was resumed on the conditions formerly existing. A strike of the gold miners in the Porcupine district against a reduction in wages, which took place on November 15, was of greater magnitude than the two first mentioned, involving approximately twenty-five mining properties and 1,200 men. At the end of January, 1913, it was reported that a large proportion of the men who were originally on strike had left the camp, and that many others had returned to work. The strike was practically ended on June 21, when an arrangement was made by which, although the strike was not officially declared off, the union permitted the men to return to work. On February 19, 1913, a strike of 500 metal miners connected with the federation occurred at Britannia Beach, B.C. The dispute arose over refusal of the company to recognize the union. A board under the Industrial Disputes Investigation Act had previously investigated the matter, and in the majority report of the board the views were expressed that the company should allow the union officials to visit the men on the employers' property to transact union business. The finding of the board was not accepted by the company, and the strike ensued. The strike was formally declared off on August 27.

There have been a number of other strikes in Canada in which members of the Federation were involved, but the foregoing include the more important of the disputes which have occurred in the Dominion.

(To be continued)

COAL PRODUCTS AND BY-PRODUCTS*

By E. Stansfield and F. E. Carter.

Methods of Producing Coke, Gas, Ammonia and Tar, from Bituminous Coal.

The employment of coal for commercial purposes may be roughly classified under three main divisions as follows: (1) the combustible matter in the coal is completely burned with an excess of air; (2) the combustible matter in the coal is completely gasified by partial combustion with a limited amount of air, or of air and steam; and (3) the volatile matter of the coal is vaporized by the application of external heat, in the absence of air.

In class 1, the coal is burned under steam boilers and in furnaces, etc. The coal is fed in and burned, heat is generated, and ashes are left. In this class, heat is the main product; the only by-products being the valueless ashes and furnace gases.

In class 2, the coal is gasified in the producer by blowing air and steam through it; but, by limiting the quantity of air supplied and having a deep layer of fuel, the coal is not completely oxidized, hence the gas produced is combustible. In this class the combustible gas is the main product, although ashes and heat are necessarily produced. The heat, which is generally kept as low as practicable by means of the steam, can be partially utilized, but is often a total loss. The gas is sometimes burned simply as a source of heat, while in other cases it is utilized as a source of power in internal combustion engines. As the gas leaves the producer it almost invariably contains more or less ammonia and coal tar, the quantities varying with the type of producer, with the amount of steam employed, and with the character of the coal gasified. By means of a suitable purifying plant, the ammonia and tar may be recovered from the gas before it is used. These residuals are the only by-products from the utilization of coal in gas producers.

In class 3, the coal is carbonized in gas retorts for the production of coal gas, and in coke ovens for the production of coke. In both cases the coal is heated, gas and other volatile products pass off, and coke remains in the retort or oven; but in the coal gas plant the gas is the main product, the coke being only a by-product; whereas in the coke-oven plant the conditions are reversed, the gas being the by-product. In both cases, however, the gas, as it leaves the coal, contains ammonia and coal tar vapors, and these are recoverable by products.

The by-products obtained from gas works and from coke-oven plants are of very great importance. Before discussing these in detail, a brief description of the plants themselves will be given.

The coking of coal for the manufacture of coke is carried out in what are known as coke ovens. There are two types of these in common use, known respectively as beehive and retort ovens.

As already stated, coal during coking loses gas and volatile matter. In some cases these are immediately burned in or adjacent to the ovens, and produce the heat required; in other cases the volatile matter is collected, its more valuable constituents saved, and only the residual gases burned. Coke ovens, therefore, whether beehive or retort, can be classified as non-recovery ovens and by-product recovery ovens.

Three types of ovens will be considered as illustrating three of the above classes. The fourth class—the by-product beehive oven—is not very important, and is not employed in Canada.

Non-recovery Beehive Oven.—This is the simplest type of oven in common use. It has a circular floor and domed roof, and is usually built of brick or stone lined with firebrick. The ovens are built back to back, in long rows, with the object of economizing heat and space. In operation, a suitable charge of coal is fed into the oven through a hole in the roof, the brickwork of the oven having been left hot enough by the preceding charge to start the coking of the coal and ultimately to ignite the volatile matter driven off. Air is cautiously admitted through loose brickwork in the door in front, and in such a way that the volatile matter escaping from the coal is burned in the oven over the charge, and the coal and the coke preserved, as far as possible, from oxidation. The heat generated by the combustion of the volatile matter is radiated down from the roof, and completes the coking commenced by the heat from the brickwork, and the whole oven is raised to a red heat. When the coking is completed—usually after about 72 hours—the coke is drawn out and quenched with water, and a fresh charge of coal is introduced into the oven. In most beehive-oven plants the coke is drawn out by manual labor, as the shape of the oven is not suitable for the utilization of mechanical extractors. Occasionally, the hot waste gases leaving the oven are carried under boilers, and used to generate steam, but otherwise coke is the one and only product of this type of oven.

Some beehive ovens have been so constructed as to allow of the recovery of by-products; but in these, the simplicity of the ordinary beehive oven is lost, without gaining the advantages obtained from the retort oven.

Non-recovery Retort Ovens.—In non-recovery retort ovens, the coal is coked in long, narrow retorts built of firebrick. The retorts may be arranged either horizontally or vertically, in batteries. They are made slightly wider at one end than the other, to allow of the ready discharge of the coke from the oven by means of a ram or by gravity. Coal is charged into a hot oven, as in the case of the beehive oven, but no air is admitted into the oven itself. The volatile products from the coal leave the oven through special ports, are then mixed with air, and burned in flues surrounding the oven. The heat of their combustion is conducted back into the oven through the walls, and the coking of the coal is thus completed. The hot gases from the flues are often used to generate steam, but otherwise coke is again the one and only product of this type of oven.

By-product Retort Ovens.—The construction and operation of these ovens is in many ways similar to that of the non-recovery retort ovens, indeed so much so that some retort ovens can be operated either with or without by-product recovery. The difference consists in the fact that, with the recovery ovens, the gases and other volatile products from the coal are led away through pipes to a hydraulic main, and thence to a recovery plant where they are passed through con-

*Extracts from a report entitled "Products and By-products of Coal," published by the Mines Branch.

densers, scrubbers, etc.; and in this way ammoniacal liquor and coal tar are obtained—as in a coal-gas plant. Enough of the purified gas is then piped back to the battery and burned in flues surrounding the retorts to keep the ovens at the temperature requisite for good coking. In this type of oven, regenerators are commonly used to preheat the air and gas before they are burned in the flues. The resulting economy is such that, unless the coal is low in volatile matter, only half the purified gas is required to heat the ovens, while the remainder—a valuable by-product—can be used for other purposes. In this connection it might be pointed out that the superior economies in the working of a by-product recovery coke-oven plant, as compared with a coal-gas plant, together with the superior quality of the coke produced, make the former a rival to the coal-gas plant, even as a means of supplying city gas; but the substitution is possible only where there is a large demand for coke of high quality.

Types of Coke Ovens Compared. — Until recent years there has been a decided prejudice against retort oven coke; the product of beehive ovens has been more in demand, especially for use in blast furnaces. This preference, however, is fortunately disappearing. As a matter of fact, retort ovens can make as good coke as beehive ovens, and can make more of it from ordinary coking coals. They have, moreover, a wider range of adaptability as they can produce a commercial coke from certain classes of coal which cannot be coked in a beehive oven. Hence the retort oven is gradually displacing the beehive oven, and in some countries the change is almost completed.

Beehive ovens, as a rule, are a nuisance in the neighborhood where they are located, they burn or waste all the gases and volatile matter generated from the coal, and they give no return except that of the coke produced. Moreover, they also burn about 10 per cent. of the coke itself. In other words, if, with a certain coal, a 75 per cent. yield of coke is obtained in a retort oven, probably only 65 per cent. would be obtained in a beehive oven. In the former case 134 tons of coal would be required to produce 100 tons of coke; whereas, in the latter case, 154 tons would be required. That is to say, for every 100 tons of coke produced in a beehive oven, 20 tons of coal, approximately, are needlessly wasted through the burning of the coke. From the ethical point of view, therefore, there can be no hesitation in condemning the beehive oven; while from the practical point of view it should be remembered that, in addition to the smaller yield, the greater waste of carbon in the beehive oven results in a higher percentage of ash in the coke produced. The beehive oven has the further disadvantage that the coking period is at least one and one-half times as long as in a retort oven, so that, if the charges are the same, it takes three beehive ovens to do the work of two retort ovens. The cost of working a beehive oven is also high, as the method of drawing the coke by manual labor is slow and expensive. The beehive oven is, however, very low in first cost, and being simple in construction, is also easy to keep in repair. These facts, together with the widespread prejudice in its favor, and the great number of managers and men familiar with its use—but unfamiliar with retort-oven practice—explain the reluctance of so many coke manufacturers to adopt retort ovens.

It is probable that in nearly all cases the non-recovery retort oven is, in the long run, more profitable than the beehive oven, and that it would certainly prove to be so in all large plants. The capital outlay is greater, but the working expenses are less; while the output of coke is at least 10 per cent. more for the same amount of coal used.

In Canada, at the present time, the profits to be gained by the recovery of by-products are more doubtful. On account of the high capital cost of a by-product plant, it is essential that there should be a reasonable certainty of working full time; hence it is usual to erect large central plants, where they are capable of drawing supplies from several collieries, and where a good market for the products is of easy access. Evidence given before a Royal Commission on Coal Supplies in England would appear to show that, there, the value of the by-products will not only pay for the working of such a coke plant, and provide a profit, but will also pay for the capital outlay within ten years. Various uses for coal tar are given later; but it seems certain that by-product recovery coke-oven plants which produce tar, and the coal-tar industry which uses coal tar as a raw product, must grow up together.

At the present time, there are only two by-product recovery coke-oven plants operating in Canada; yet in 1913 these two plants were responsible for two-thirds of the total coke production of the Dominion. As coke is imported, their production, however, only amounted to half the total consumption of coke in the Dominion. We may confidently expect that the tendency of the future will be towards the recovery of coal tar and ammonia at all coke and gas plants.

Properties and Uses of Coal Products and By-products

Coke is the name given to the solid residue left by the destructive distillation of coal, or of some other carbonaceous substances. It consists mainly of carbon, together with the original ash of the coal, but always contains small amounts of volatile matter which the temperature attained in the coking process has failed to drive out during the time the heat was maintained.

When coal is strongly heated in absence of air, it is decomposed, and loses water, gases and volatile compounds. Many coals so heated first fuse or soften, and then harden as decomposition progresses, ultimately leaving a strong coke. This coke, although quite hard, is light and cellular, owing to the bubbles produced by the escaping gases while the mass is soft. Neither anthracite nor lignite coalesces when heated, hence neither is capable of making commercial coke. The fragments left after the heating might strictly be described as coke, but they are approximately the same size and shape as the original pieces of coal, and bear little or no resemblance to the hard porous substance commercially known as coke. Some bituminous coals also fail to coke, or else make so weak or impure a material as to be worthless.

Coke bears the same relation to coal that charcoal does to wood. For many purposes, such as blast furnace smelting coke is so far superior to coal as a fuel that it is necessary to go to the trouble and expense of coking the coal before use. The chief advantages of coke as a fuel are:

1. It is strong and hard, and does not crumble or soften when burning; thus it can support a heavy charge of ore, etc., in a furnace, without crushing or melting down and obstructing the blast.

2. It burns without producing tar or smoke.

3. It has a high calorific intensity; that is to say, a higher temperature can be obtained by burning coke than by burning coal, although a given weight of coal will naturally evolve a larger quantity of heat than will the coke produced from it.

Coke is the main product of cokeoven plants, and is a by-product of gas plants. A coke manufacturer selects coal that is capable of giving good coke, and treats it in such a way—with regard to the mass coked, temperature of oven, and duration of coking—as will produce a good quality of coke. The gas manufacturer naturally regards the quantity and quality of gas produced as his chief consideration, the quality of coke being only of secondary importance; his choices of coal, etc., are, therefore, all made from the viewpoint of gas production. Consequently gas or retort coke is practically always inferior to oven coke, as regards hardness, strength, lustre, etc.; but the former has advantages over oven coke for certain purposes, since it contains more volatile matter, and consequently burns more readily.

The most important uses of coke are in metallurgical operations, such as the smelting of iron in blast furnaces; the remelting of iron in the iron foundry; and the smelting of copper, lead, nickel, silver, etc. Oven coke is always used for these purposes, as a strong, hard coke is required. For blast furnaces, great compressive strength is essential; but for copper smelters, porosity is important. During 1913, 1,417,148 tons of coke was used in the blast furnaces of Canada; this amounted to about 65 per cent. of the total consumption of metallurgical coke in the Dominion.

Gas coke is chiefly used for steam raising, domestic heating, etc. It has the great advantage over soft coal that it can be burned in an ordinary grate without producing smoke and soot; this is a matter of great importance for the cleanliness of our cities even now, and will become more so as the cities increase in size. Where hard coal is burned, nothing is gained as regards smoke reduction by a change to coke; there is, however, a great deal to be said in favor of coking all bituminous coal that will form a commercial coke, thus obtaining the two clean fuels coke and gas, and recovering the valuable by-products tar and ammonia.

Gas coke can prove satisfactory for steam raising only where it is burned under suitable conditions. It has a comparatively high temperature of ignition—although not so high as that of oven coke—and requires a good draught. It gives a more localized heat than coal, on account of the absence of flame, and when burning freely gives a more intense heat; it is therefore liable to cause troubles such as the burning of the firebars and the formation of clinker. The latter trouble is accentuated by the fact that coke naturally contains a higher percentage of ash than the coal from which it is made. The difficulties attending its use are, however, not unsurmountable, as is shown by its successful use in many plants. A suitable furnace should be employed, and the method of stoking adapted to the fuel. Crushing the coke to a small uniform size is generally advantageous. Troubles due to ash and clinker would be reduced if the coal for use in gas plants were first washed, as is frequently done with coal for coke-oven plants. Washing the coal would also reduce the sulphur in the resulting coke.

Ammonia is obtained as a by-product in the distillation of coal in gas works, in coke-oven plants, and in producer gas plants. The quantity depends on the percentage of nitrogen present in the coal; but other factors, e.g., the temperature and shape of the retorts, ovens or producers have also an influence on the fraction of the nitrogen which is evolved as ammonia. Generally nitrogen is present in coals to the extent of one or two per cent., but in gas works only about 14 per cent. of this is recovered as ammonia in the gas; this latter percentage may be sensibly increased by adding lime to the coal, or by passing steam through the retort during distillation. Increasing the steam used also increases the ammonia yield from gas producers. The Mond producers are run so that a very high yield of ammonia, amounting to about 60 per cent. of the nitrogen of the coal, is obtained by means of the large excess of steam which is passed through the fuel bed; the steam favors the increased percentage of ammonia by lowering the temperature of the producer below the point at which ammonia decomposes, and also by acting as a diluent to the gases evolved.

In gas and coke-oven plants some of the ammonia is washed out from the gas in the hydraulic main, purifiers, etc., but the bulk of it is recovered from washers and scrubbers installed for the purpose. As small a volume of wash liquor as possible is used in these washers, to prevent undue dilution of the ammonia in the resulting ammoniacal liquor.

Coal gas and coke-oven gas contain ammonia, carbon dioxide, sulphuretted hydrogen, cyanides, etc. As these gases combine chemically and dissolve in water, the ammoniacal liquor obtained is a complicated solution containing the following ammonium salts: acid and neutral carbonates, acid and neutral sulphides, thiocarbonate, cyanide, thiocyanate, ferrocyanide, sulphate, thiosulphate, sulphite, chloride and acetate. Because solutions of the carbonates, sulphides, cyanide and acetate readily give up their ammonia when boiled the ammonia in these salts is called "volatile." The other compounds require the addition of lime to liberate the ammonia, which in these salts is said to be "fixed." The ratio between the "volatile" and "fixed" ammonia in gas liquors varies widely, but that liquor with the largest proportion of "volatile," is naturally the most valuable. In producer-gas plants the gas is washed in towers by dilute sulphuric acid, and ammonium sulphate is directly produced.

The ammoniacal liquor obtained as above is distilled before and after the addition of lime, and the ammonia liberated is passed into sulphuric acid yielding ammonium sulphate, or into water yielding the ammonia solution generally known as ammonia, ammonium hydroxide, ammonia water, etc. This treatment of the gas liquor is not profitable in smaller plants, and from such places the liquor is generally shipped to central plants for distillation.

Uses of Ammonia—A strong solution containing about 10 per cent. ammonia, as obtained by simple distillation, is largely used for the manufacture of ammonia soda, and for cleaning purposes; while the more concentrated solution "liquor ammoniae," and anhydrous liquid ammonia, are used in refrigerating machinery. Ammonium nitrate, which is usually made from ammonium sulphate and sodium nitrate, is being increasingly used in explosives. Ammonium chloride, which is produced directly from the gas liquor, or from ammonium sulphate by boiling with common salt, or obtained from waste liquors of ammonia soda works, is used for soldering, for galvanizing iron, for calico printing and for batteries. A process by which ammonia is converted into nitric acid has recently been patented in Switzerland and will probably prove to be a very important applica-

tion of ammonia. Ammonium sulphate is the most important salt of ammonia; its possible useful application as a fertilizer is practically unlimited. As yet the need of fertilizers has not been felt so keenly in Canada as in older established countries, but its use here is bound to extend rapidly. During the last year there has been a tendency for the price of ammonium sulphate to drop, partly owing to the competition of other fertilizers now produced on a large scale by the fixation of atmospheric nitrogen by electrothermic processes, and partly owing to the progress which is being made with Haber's synthetic process for ammonia production. The war has caused a brisk demand for nitrates in the manufacture of explosives, and the removal of these nitrates from the fertilizer market, should bring about an increase in the price of ammonium sulphate.

Cyanides.—In the dry distillation of coal, up to 2 per cent. of the nitrogen of the coal is evolved in the form of cyanide, and is recovered both in the washers and scrubbers along with the ammonia, and in the purifiers where ferrocyanide is formed with the ferric oxide. The potassium cyanide, ferrocyanide and ferricyanide, which are worked up from cyanogen compounds of the gas, are very important by-products of the gas industry. In the twelve months ending March, 1914, Canada imported 1,615,490 lb. of potassium and sodium cyanides and 166,901 lb. of yellow and red prussiate of potash (potassium ferro and ferricyanide). The simple cyanides have a wide application in mining operations; the yellow prussiate is used for making potassium cyanide, for dyeing and for case hardening steel; and the red prussiate is much used in photography.

Coal-tar.—Probably the greater part of the world's production of tar is distilled in order to obtain the more valuable products described later; but there are many uses for entirely raw tar, or for tar in its dehydrated state (i.e. after it has been heated in closed vessels to remove the water, and, incidentally, to recover the benzol). Dehydrated tar finds wide application in the preparation of roofing felt, and for preserving timber, stone, iron, etc. Tar has, weight for weight, a slightly higher heating value than coke, and is now being used as a fuel. Formerly it was simply poured on to solid fuel, but under these conditions combustion was by no means complete; now the tar is usually injected in the form of a fine spray by means of steam or air and so comes in intimate contact with the air, this resulting in complete combustion. Tar is sometimes simply mixed with coke for heating retorts in a gas plant or used in conjunction with coke-oven gas for heating coke ovens. It is also converted into a gas by being passed through red-hot tubes.

There are so many valuable products which may be obtained from tar that its use as a fuel is, from the standpoint of conservation, to be condemned; but it must be admitted that in very many cases the tar has to be used in this way. Large gas and coke-oven plants can profitably have a tar-distilling plant in addition; but the distillation of tar in small works is not remunerative. In the latter case, the tar may be shipped to central distilling plants, but even this procedure is not commercially possible where the gas or coke-oven plant is isolated, and consequently the cost of transportation high. In such cases the use of tar for fuel is the only possible one.

Coal tar is distilled in wrought iron stills. These stills are usually upright cylinders of 10 to 20 tons capacity, sometimes heated by steam, but more often by a direct fire. As water in tar sometimes causes bumping in the stills, it is removed as completely as possible before hand. With thinner tars the water settles out on the surface at ordinary temperatures sufficiently well to be run off, but thicker tars require to be moderately heated to cause a satisfactory separation. The still-head is connected with a condensing worm, from which the various products of distillation are conducted into different receivers. At the end of the distillation process, the fire is drawn out and the temperature allowed to fall to a point at which the pitch left behind in the still—though remaining liquid—will not ignite when it comes in contact with the air. This pitch is then run out into barrels, or other suitable receivers. Sometimes, in the last stages of the distillation, superheated steam or a vacuum is utilized, since either of these causes the high-boiling-point products to pass over at a lower temperature than would otherwise have to be employed. Recently, tar has been successfully treated in continuous distillation apparatus.

As is shown below, the various first products of coal tar give, on refinement, numerous compounds of supreme importance in technical chemistry. The amounts of these compounds obtained from tar vary considerably with the nature of the tar itself; and the following figures merely give an approximate idea of the quantities which may be expected from an average coal tar:

	Per cent.
Derivatives of Coal Tar—	
Benzene and homologues	2.5
Phenol and homologues	2.0
Pyridine and other bases	0.25
Naphthalene	6.0
Heavy oil	22.0
Crude anthracene (30% pure)	1.5
Pitch	60.0
Water and loss	6.0

Commercial Products of Coal Tar: Their Uses and Derivatives.

90% Benzol.—Uses—As a solvent for the manufacture of colors, for extracting fat from bones and seeds, and for making iron varnishes; also, as a detergent; as a fuel for internal combustion engines; and for carburetting gas.

Derivatives—By distillation, pure benzene, toluene, xylene, etc., are obtained. Benzene is widely used in the preparation of numerous technical organic products. From it nitro-benzene, aniline, etc., are readily obtained, and therefore it is the parent substance of the numerous aniline dyes; of many artificial perfumes; and of photographic developers, etc. Toluene and xylene are used in the preparation of certain dyes. The former gives on nitration trinitrotoluene, a substance used in the manufacture of explosives.

50% Benzol.—Use—As a substitute for the 90 per cent. benzol, in the manufacture of certain dyes.

Solvent Naphtha.—Uses—As a solvent for rubber in the preparation of waterproof fabrics; as a detergent; and a solvent in the purification of anthracene.

Crystalline Carbolic Acid.—Use—As an antiseptic. Derivatives—By nitration, carbolic acid gives picric acid, which is used in the manufacture of many important explosives, and of some dyes. It is the source of many substances used in the color industry (e.g. salicylic acid), and of certain photographic developers (e.g. metol).

Liquid Carbolic Acid.—Uses—As a liquid antiseptic and as the active principle of disinfectant soaps, powders, etc.

Naphthalene.—Uses—For carburetting gas; for disinfecting purposes; for driving explosive motors; for preserving raw hides; and, sometimes also for fuel. Crude naphthalene is usually employed for the above purposes.

Derivatives—Pure naphthalene is the starting point in the manufacture of a large number of important artificial colors (phthalein colors, azo-colors, indigo, etc.).

Heavy Oil; also called Creosote oil.—Uses—As an illuminant where smoke is no objection; as an antiseptic; as a timber preservative; as a lubricant; as a binder, when mixed with pitch, in the manufacture of patent fuels; as a fuel, and as a solvent.

50% Anthracene.—Uses—Not important.

Derivatives—Anthracene is the raw material from which alizarin and other important coloring matters are manufactured.

Anthracene Oil.—Uses—For lubricating purposes; for timber preservation; for making soft from hard pitch; for removing naphtalene from coal gas.

Pitch.—Uses—For road making; for preparing artificial asphalt by admixture with heavy oil; for manufacturing varnishes by admixture with middle oil; for making patent fuels, after softening by admixture with heavy or anthracene oil; for insulating cables, etc.; for roofing; and for making coke for electric carbons.

U. S. BUREAU OF MINES REPORT ON COAL TAR PRODUCTS.

The United States has recently been brought to a realization of its dependence upon German sources for coal-tar and "gas benzol" by-products, and this unenviable situation, which applies to Canada as well, is no more to their liking than it is to ours. With characteristic alacrity, however, which by the way, our department might advisedly emulate, their Bureau of Mines has published a synoptical and comprehensive pamphlet* pertaining to the ability of the United States to meet its own requirements in these commodities. Such published information will undoubtedly serve to stimulate the industries involved to greater effort; and as it is of great moment to us in Canada as well, and as we possess the same potentials for like industries, it is of timely interest to extract some of the salient features from this pamphlet.

Coal-tar in general comprises from 3 to 5 per cent. of bituminous coal (by weight), say 7 gallons per ton of coal. Ten per cent. of coal-tar can be made into drugs and dyes. Ninety per cent. of coal-tar can be made into pitch and various heavy oils.

A table showing the crude fractional distillation products of coal tar with their uses is given and is as follows:

Fractions of Average Coal Tar and Their Uses.

First crude separation by distillation.	Light oil	Middle oil (or dead oil).	Heavy oil (including anthracene oil).	Pitch.
Temperatures of distillation.	70°-160° C.	160°-230°C.	230°-360°C.	Above 360° C.
Percentage in tar.	3.	8.	24.	65
Intermediate products, by distillation or other expression.	Benzene, toluene, xylene, etc., phenol.	Phenol, cresols, etc.; naphthalene, heavy hydrocarbons.	Cresols, naphthalene, anthracene; heavy hydrocarbons; quinoline bases.	Soft pitch, hard pitch.
Crude commercial products and their uses.	"Benzol" and solvent naphtha for solvents, paint thinners, motor fuel, gas enrichment.	Creosote oil. Lamp black. Disinfectants.... Road oils, impregnation of timber.		Pitch, briquetting, protective paints. Roofing tars. Paving tars.
Intermediate chemical products.	Nitro benzene, aniline salts, aniline oil, carbolic acid.	Carbolic acid, picric acid, phthalic acid, naphthols, naphthylamines, salicylic acid	Anthraquinone, alizarin.	
Refined chemical products, dyes, etc., and their uses.	Nitrotoluenes, diphenylamine and other ingredients of explosives; aniline dyes; hydroquinone and other photographic developers; drugs and medicines.	Picric acid, picrates and other nitro compounds for explosives; naphthol dyes and colors, artificial indigo, refined carbolic acid.	Alizarin dyes.	

*Coal Tar Products and the Possibility of Increasing Their Manufacture in the United States by Herman ... Chapter on Coal Tar Products used in Explosives by E. G. Crane. Technical Paper 88, Bureau of Mines, 1915.

Gas benzol, or light oil, is abstracted from coal gas. Gas benzol comprises nearly 1 per cent. (by weight) of high grade gas coals, say 1½ gallons per ton of coal. One hundred per cent. of gas benzol can be made into dyes and refined preparations.

About 25 per cent. of combined yield of tar and "benzol" may be turned into dyes, drugs and refined chemicals which were heretofore obtained from Germany.

Germany's leadership in production and utilization of these by-products is well instanced by the following comparative figures for 1913:

	Germany.	U. S.
Coal output, tons	295,000,000	475,000,000
Coal-tar, gals.	250,000,000	150,000,000
Benzol, gals.	50,000,000	7,500,000
Coal-tar imported, gals. ...	3,500,000	500,000
Value of exported dye-stuffs	$55,000,000	.....
Value of imported dye-stuffs	.....	*$10,000,000

*Practically entire consumption.

The raw materials "coal-tar" and "benzol" are obtained from by-product coke ovens and gas retorts.

"Benzol" in illuminating gas has so far been a requirement, and until illuminating gas gives way to fuel or heating gas, or until some other illuminant derived from the same sources be substituted, it is unlikely that municipal gas-making plants would strip the "benzol" for other purposes.

The chief coal-tar products with their uses may be summed up as follows:

Creosote oil.—Comprises 15 to 30 per cent. of the coal-tar. Water-gas tar on the other hand yields no true creosote, although this tar is sometimes substituted for creosote. Creosote is largely used for the impregnation and consequent preservation of wood, such as railroad ties, mine and structural timbers, piling, paving, blocks, etc.

Light oils, benzols and solvent naphthas.—The light oil contains benzene, toluene, xylene and small proportions of other compounds. This distillate is the basis of aniline dyes, certain nitrocompounds used in explosives, also medicines, drugs and photographic chemicals.

The light oil is used for solvents, cleansers, pitch-paint thinners, gas enrichment, etc.

Heavy tars and pitch products.—Comprise 50 to 80 per cent. of the tar. They are useful for road binders, road-treatment oil, roofing papers, roofing pitches and protective and waterproofing paints. The hard pitch product is utilized as a binder for briquetting coals, and for certain electrical uses.

Naphthalene and anthracene, useful for certain dye-stuffs, can be extracted from these fractions without detracting from the other uses enumerated.

Aniline dyes.—These are obtained chiefly from benzene, toluene and phenol through the preparation of nitrosubstitution products of these and various complex chemical transformations or combinations with other materials. In the process of manufacture sulphuric, nitric and acetic acids, caustic alkalies, alcohol, zinc dust, sodium nitrate, chlorine and bromine are requisitioned.

Naphthol Dyes.—Obtained through the intermediate products of naphthalene, such as naphthols, naphthylamines and phthalic acid.

The eosin dyes are derived from resorcin (a benzene product), and phthalic acid.

Artificial indigo is a product of naphthalene.

Five to ten per cent. of the tar content is naphthalene.

Alizarin dyes.—Made from anthracene by oxidizing the latter to anthraquinone, and then converting this into various hydroxy-anthraquinones and their derivatives, alizarins, purpurin, etc.

Between 1 and 2 per cent. of crude anthracene is contained in coal-tar.

The dyes enumerated above are the chief ones, although there are others of less importance.

Carbolic acid or phenol.—Is distilled from the light and middle oils. 0.3 to 1.0 per cent. of the crude tar is phenol. Carbolic acid is also produced synthetically from benzene through benzene-sulphonic acid.

Phenol, aside from its antiseptic uses, may be utilized in the manufacture of picric acid for explosives and certain dye-stuffs.

A substance resembling celluloid can be obtained by condensing phenol with formaldehyde.

Miscellaneous chemicals and drugs—such as benzoic and salicylic acids, certain photographic developers, hydroquinone, etc., acetanilid, acetphenetidin (phenacetin), saccharin, antipyrin, acetyl salicylic acid (aspirin), phenolphthalein, and many other drugs.

Explosives.—Mention has been made of the importance of coal-tar products in the manufacture of explosives.

The raw materials are benzene, toluene, naphthalene and phenol (carbolic acid). These are used in the various nitrosubstitution products which form the basis of explosive mixtures so much in demand for rock and other blasting purposes, as well as for purposes of war and sport.

The chief nitrosubstitution products are nitrobenzenes, nitoluenes, nitronaphthalenes, picric acid and picrates.

The pamphlet concludes with a short monograph by Mr. Horace C. Porter upon the "Commercial and Economic Phase of the Coal-tar Situation," which, on the whole, is favorable to the adoption of measures whereby the industry could be encouraged in the United States. One of the considerations which affects them is the validity of certain German patents upon chemical processes involved in the manufacture of some of the products. In Canada these could, and should, be overridden at this time by annulling any rights a German subject may have in so far as every such patent applies to Canada.

GOULD CONSOLIDATED.

According to "Financial Times," Gould shareholders at a meeting in Ottawa endorsed the following proposals: That the present company be re-organized, the capitalization being reduced to $2,000,000 from $3,000,000; that 250,000 shares of the par value of $1.00 be given to parties for two claims in the Porcupine district, which the owners of the claims have accepted; that 751,000 shares be given to a syndicate in Detroit for $75,000; that 750,000 shares be given the present shareholders of the Gould stock, which would be a ratio of one share new to four shares old, and that 249,000 shares of the new stock be left in the Treasury. The company also intends to try and release the property in Cart Lake from the Peterson Lake Company, which lease was cancelled a few months ago. The giving of 751,000 shares to the Detroit syndicate has given them control of the company. If the company can re-lease the Cart Lake property they intend to actively work it. The same directors as were appointed to manage the old Gould have been appointed to the new company.

PERSONAL AND GENERAL

Mr. James Cronin, of Spokane, Washington, who owns mineral claims in the Babine mountain section of Omineca mining division, British Columbia, was in Victoria recently, on his way home after having spent several months on his mining property.

Mr. J. H. Roaf, manager for the Pacific Coast Coal Mines, Ltd., with coal mines at South Wellington and other parts of Vancouver Island, is now with the military forces in British Columbia preparatory to leaving for active service in Europe.

Mr. George E. Farish, formerly manager of the Motherlode Sheep Creek Mining Company, with a gold mine and modern stamp mill at Sheep Creek, Nelson mining division of British Columbia, was lately examining mining property in New Mexico for New York clients.

Mr. James L. Bruce, of Butte, Montana, manager for the Butte & Superior Copper Company, has been spending a summer vacation with relatives at Victoria, British Columbia.

Mr. Thos. Kiddie has returned to Alhambra, California, after having spent the summer at the home of his eldest son, Mr. John Kiddie, in Morenci, Arizona.

Mr. K. C. Pepper has been appointed mill superintendent at the Schumacher gold mine, Porcupine.

Mr. Gwynne G. Gibbons, for some time with the Canadian Exploration Co., investigating mining properties in Ontario and British Columbia, has obtained a lieutenancy in the Royal Engineers, and is now with the 200th Field Company at Morecambe, England.

Mr. J. Cleveland Haas, of Spokane, Washington, is developing under option of purchase, some promising copper claims in the northern part of Vancouver Island.

Mr. J. E. McAllister, of Toronto, has returned from a trip to the Pacific coast.

Mr. E. Jacobs, of Victoria, and Mr. Dudley Michell, instructor in first aid and mine rescue work for the British Columbia Department of Mines, attended a first aid and mine rescue meeting at Cle Elum, Washington, on July 31. Thirteen teams, each of six men, took part in the first aid contests, and seven teams of five men each in the mine rescue events, of which latter Mr. Michell was judge.

Mr. John Hopp, of Barkerville, B.C., who was in Victoria about the middle of August, stated that summer rains had been of great value to hydraulic miners in the Cariboo district, having prolonged the gravel washing season which, owing to the unusually light fall of snow last winter, had been expected to have been shorter than usual.

Mr. Thomas French has returned to Nelson, B.C. from a visit to Ottawa whence he went with the object of seeking aid from the Dominion Government for the establishment on a commercial basis in West Kootenay of zinc-roasting works to use the French process for the recovery of zinc.

Mr. R. G. McConnell Dominion Deputy Minister of Mines, has returned to Ottawa from a visit to Western Canada.

Mr. O. E. LeRoy, of the Geological Survey of Canada, has been engaged lately in obtaining information relative to the iron resources of British Columbia.

Major Guy H. Kirkpatrick, mining engineer, of Vancouver, B.C., of the 72nd Seaforth Highlanders, has been granted the temporary rank of lieutenant-colonel.

Mr. R. H. Ley, who several years ago was conducting an assay office at Nelson, B.C., and later was with the Giant Powder Company, is in camp in British Columbia with forces training preparatory to proceeding to Europe.

Dr. Charles W. Drysdale, who on July 15 presented an interesting paper on the geology of the molybdenite ore deposit at Lost Creek, in Nelson mining division, British Columbia, before the meeting of the western branch of the Canadian Mining Institute, held at Rossland, has returned to the Bridge River section of Lillooet district, where he will spend the remainder of the field season making geological investigations in that part of British Columbia.

Prof. F. M. Handy, of the mining engineering department of the State College of Washington, Pullman, Washington, was recently in the Ymir district of British Columbia, whence he went to meet Prof. Francis A. Thomson, head of that department, and confer with him relative to some mining problems there on which the latter engineer had been engaged to advise.

Mr. Graham Cruickshank, of Rossland, who had been in charge of the Consolidated Mining and Smelting Company's experimental concentration plant there, has gone to Victoria to prepare for taking an officer's commission with His Majesty's military forces.

Mr. John D. Galloway, of Victoria, B.C., assistant Provincial mineralogist, is spending part of the field season in East Kootenay. Later he will probably give attention to parts of Nelson mining division.

Mr. W. L. Wotherspoon, consulting mechanical and electrical engineer of the Canadian Mining & Exploration Company, Ltd., has returned to New York after a three-month trip in the Western United States and Alaska.

Mr. J. A. Allan, of the University of Alberta, was in Toronto during August.

Mr. E. V. Neelands, manager of the Cobalt Comet, and formerly manager of the Hargraves mine, has been appointed manager of the Potaro mine, New Guiana. Mr. Neelands will leave for South America about the middle of September.

Mr. W. F. Ferrier has returned west after a short stay in Toronto.

Mr. A. G. Burrows is in Toronto completing a map of the Porcupine gold district.

Dr. W. G. Miller has returned to Toronto from Northern Ontario.

Mr. C. W. Knight is at Sudbury.

Mr. J. E. W. Sweet left San Francisco on August 14 for Mazatlan, Mexico.

Mr. R. R. Van Valkenburgh, of Juneau, Alaska, and Miss Paula Haire were married in Salt Lake City on August 18.

Mr. A. B. Clabon has been visiting Cobalt and Porcupine mines and is now in Toronto.

Mr. Frank Loring is at Goodfish Lake.

Mr. H. W. Hardinge is visiting mines at Cobalt and Porcupine.

Mr. Elias Rogers, president of the Crow's Nest Pass Co., and Miss Anna E. King, of Hampstead, England, were married last week in New York.

STANDARD SILVER-LEAD MINING CO

Standard Silver-Lead Mining Company showed a net profit of about $85,000 for July. Directors have declared a dividend of 2½ cents a share, payable September 10 to stock of record August 31. Transactions call for $40,000. The company has almost as much shipping ore on platforms as it had when it started on July 1 last.

SPECIAL CORRESPONDENCE

BRITISH COLUMBIA

New Plant at Trail.—A press despatch from Ottawa published in British Columbia about the middle of August included information to the effect that several conferences have been held between the Shell Committee and the Dominion Cabinet, the result of which is contained in the statement of General Bertram that agreements have been made and were closed for the refining at Trail, B.C., and other places, of both copper and zinc. It has been known for several weeks to a comparatively few well-informed men resident in British Columbia that there had been negotiations between the management of the Consolidated Mining and Smelting Company of Canada, Ltd., and the Dominion Government relative to the refining of copper at Trail, and that preparations in that direction were already being made. The work of putting in a copper converting plant at the Trail smeltery was arranged for some time ago, and when the plant was visited early in July it was seen that space for the converters was being cleared on the matte-tapping floor. The electrolytic refining of lead has long been an important part of the company's industry at Trail. It was to be expected that in due course the electrolytic refining of copper would also be undertaken there, and the time has now arrived for an extension of the company's operations in this direction.

Ymir Mining Camp.

While there has been little mineral production from properties in Ymir camp, Nelson mining division of West Kootenay, during the last two years, development work has been in progress at several mines, among them at least two that in earlier years made a considerable output of gold ore. These are the Wilcox and the Yankee Girl. Others that have been worked since production practically ceased are the Dundee, Jennie Belle, Canadian Pacific, Porto Rico, Iowna, Nevada, Commodore, and still others the names of which are not just now recalled. During the 1914 field season, Dr. Chas. W. Drysdale, of the Geological Survey of Canada, spent several weeks in the camp, he having been instructed, "in order to aid in the mining development of this camp to make a sketch topographical and geological map of the region, and to pay special attention to the working mines and deposits of prospective value." From a published brief outline account by Dr. Drysdale, the following notes have been taken: "The area assigned includes the mineralized zone lying south of Halls, east of the crest of Quartzite range, and north of Salmo. The west boundary of the map-sheet is about five miles west of the Nelson and Fort Sheppard railway, and includes the Fern and Porto Rico mines. The town of Ymir—the centre for the gold camp of the same name—is situated on the Nelson and Fort Sheppard railway 27 miles south of Nelson and seven miles north of Salmo. The Ymir camp is one of the oldest lode mining camps in British Columbia. In 1885, the Hall Bros., who two years later discovered the Silver King mine near Nelson, made locations near the headwaters of Wild Horse creek, which flows into the Salmon river near Ymir. In 1893 the construction of the Nelson and Fort Sheppard railway (which connects with the Spokane Falls and Northern railway and so completes railway communication between Nelson and Spokane, Washington), afforded easy access to the district. It was not until the summer and autumn of 1896, however, when the mining boom was on at Rossland, that prospectors began to pay attention to outside districts. It was then that mining activity really commenced at Ymir, and among the many mineral claims that were staked in 1896 were the Ymir, Elise, Dundee, Wilcox, Porto Rico, and others. In 1897, Mr. R. G. McConnell, now Dominion Deputy Minister of Mines, examined and reported (see Summary Report of the Geological Survey, Canada, 1897, pp. 31-32 A) on the district in connection with the preparation of the West Kootenay map-sheet. For several years the camp had a comparatively steady growth, free from mining booms, and many of the properties then in operation have been working intermittently ever since, whereas others through complications in geological structure and for other reasons have been abandoned."

As Ymir camp is again having the attention of mining men, the present is probably an opportune time to recall that some years ago the chief production of lode gold was from the Ymir mine, relative to which the following information was given in the "Report of the Mining and Metallurgical Industries of Canada, 1907-8," issued by the Mines Branch of the Canada Department of Mines in 1908.

The Ymir Gold Mines, Ltd., incorporated in 1898 and reconstructed November 21, 1902, capital £200,000, owns, under Crown grant, four mineral claims aggregating 163 acres, situated on the north fork of Wild Horse creek, five miles from the town of Ymir. At this mine a quartz vein has been very extensively developed, and large bodies of ore stoped; notably that known as the Bonanza orebody, which was 480 ft. long, 500 ft. deep and between 10 and 40 ft. wide. The ore shows a comparatively heavy mineralization of chiefly pyrite, galena and zinc blende, and occasionally has developed bunches of shipping ore. During the years 1900 and 1901, the output of the mine approximated 5,000 tons a month. An 80 stamp mill was in operation, while active development work was in progress, including the driving of a tunnel to tap the vein at a depth of 1,000 ft.; and a cyanide plant was installed. The recoveries in bullion and concentrate at that time represented a value of about $9 a ton, while the cost, including actual mine development, but exclusive of expenditure on account of the long tunnel operations, was from $3.50 to $4 a ton. Meanwhile, the development of the lower levels has afforded very disappointing results; for although a considerable quantity of ore was mined from Nos. 6 and 7 levels, such ore as was encountered in the lower workings occurred in isolated bunches, and no definite ore shoot has as yet been cut in the tenth level. The mill has treated to date about 350,000 tons of ore; some 20,000 tons of concentrate, and nearly 600 tons of crude ore have been shipped to smelting works. The mill building proper is a structure 160 ft. long by 83 ft. wide, provided with ore bins at the rear. The equipment includes stamps of 850 lb. each, crushing to 50 mesh at the rate of 2.5 tons daily. Concentration was accomplished by 24 Frue vanners. The mill was operated by water power, aided by steam, both being connected on the same line shaft. The cyanide plant is situated half a mile below the stamp mill, the difference in altitude being 300 ft. A riffled launder, 6 x 8 in., equipped with drop boxes, conveyed the pulp from the mill to the cyanide plant. Experiment having determined that the chief value was contained in sands, the plant was erected for percolation, and the classifiers were so arranged as to run

slime to waste, which represented about 20 per cent. of the ore. The plant comprises six steel riveted tanks 30 ft. in diameter, and provided with Butters distributors; it was operated by a Pelton wheel under 320 ft. head. A compressor, previously operated at the mill by steam, was removed to the cyanide plant building and was there driven by water power, the driving wheel having been increased and 24 buckets attached. It may be added that the Ymir Gold Mines, Ltd., paid dividends to a total of £60,000. Among its managers at different periods were Messrs. J. Roderick Robertson (deceased), S. S. Fowler, G. H. Barnhart, R. M. Atwater, Jr., and S. J. Speak. It is hoped that renewed efforts will yet be made to find the vein, which is believed to have faulted, at the 1,000 ft. level.

Little information has been made public of late concerning the Wilcox mine, another Ymir property that some years ago yielded profit to its operators, but it is known that developments at greater depth have proved the occurrence there of ore of higher value than in the levels above.

Coast District.

Granby.—Metalliferous lode mining in the Coast district is now giving employment to more men than at any other time for years, probably more than ever before. Copper mines have much bigger payrolls than either gold or silver-lead, especially those of the Granby Consolidated and Britannia companies. The Granby Co. is reported to be operating at full capacity, sending down from its Hidden Creek mine to its smeltery at Anyox by far the greater portion of the ore required to keep the furnaces of its reduction works in blast. Figures published in Boston show a production of copper at Anyox for five months to June 1 of approximately 7,455,000 lb. For May the output was placed at 2,021,000 lb. Estimating a production at a similar rate during June and July, a total of between 11,000,000 and 12,000,000 lb. of copper from that source seems to be about what has been made this year. It has been stated that a fourth blast furnace would be completed before the end of August, in which case a larger monthly output of copper may be made hereafter.

The Britannia Co. has been pushing on with its construction work, and the installation of new plant and machinery, for the further equipment of both mine and concentrating mill. The destruction of the upper terminal of its aerial tramway and the ore crushing plant at the mine, by the slide which several months ago wrecked part of the upper mine camp, caused a suspension of ore production, but with the completion of the renewal and new works now being vigorously pushed on, a considerably increased output will be made and thereafter regularly maintained.

The Tacoma Steel Co. has been engaged for more than a year in opening its Marble Bay gold-copper mine, situated near Van Anda, Texada island, at about 300 and 400 ft. deeper than what has been known as the 1,000 ft. level. The bottom level, known as the 1,400 ft. level, is actually only 1,260 ft. in vertical depth. Ore has been found by diamond-drilling, and the development work of the last year or more has had for its chief object the opening of the ore-shoots thus proved to occur at greater depth than those in which mining had previously been done. An increase in output from this mine is, consequently, expected to be made.

Copper ore is also being mined in Omineca mining division; published reports have lately placed the output from a mine on Rocher Deboule mountain, a few miles from Hazelton, at about 100 tons a day, that being the quantity stated to be sent to the Granby Co.'s smelting works at Anyox. Newspaper reports have appeared of mining operations in various other parts of the Coast district, but as some of these are plainly unlikely to be true, it will be best to await verification, or a statement of facts before giving further publicity to them.

COBALT AND GOWGANDA

While the price of silver has fallen below its record low level there is certainly a good deal of anxiety as to the future of this particular market. There appears to be no two men who can agree upon the prospects. Factors which apparently would lead to optimism, such as a good crop in India and the probability of standardization does not affect the price. The one barometer of the price of silver appears to be the good or ill success of the Allies. Ever since the war broke out the price of silver has closely followed the apparent progress made by the Allied powers, and there is no great reason for believing that until the war has shown a very definite promise in the direction of victory for the Allies and through this victory—peace—there will be any great advance in the price of the white metal. In spite of this uncertainty, however, the development of prospects is being proceeded with vigorously.

The Trethewey Mining Company has made final arrangements with the Lumsden Mining Company so that they can use their shaft to explore the Rochester. Some time ago a crosscut under contract from their 300 ft. shaft was run 150 ft. into Rochester ground. The Trethewey has now leased this shaft and will use it and the crosscut as a basis of operation.

Twentieth Century.—Near North Cobalt the Twentieth Century Mining Company has drilled and shot the first round of holes since work was resumed.

The Mining Corporation of Canada is opening up J. B. 2, the forty acres of ground which was formerly held by the Little Nipissing Mining Company. The Little Nipissing mortgaged their property to Sir Henry Pellatt and Sir Henry turned it over to the Mining Corporation of Canada.

The lessees of the Princess, Messrs. Smith and Walther, are now running a crosscut under contract with the Mining Corporation of Canada from their 135 ft. level. This crosscut has now been pushed 200 ft. The intention of the company is to discover what ore there is along the Cobalt Lake fault which runs almost the entire length of the property.

The Mining Corporation of Canada is the more encouraged to carry out this work since the remarkable discovery that has been made on the fault on the Cobalt Lake itself. At the 430 ft. level the vein along the fault was of remarkable width in massive nickeliferous and cobalt, but silver values were quite low. A raise was put up, and as it progressed bunches of high grade ore were found in the vein. A level was then run at 380 ft., with the result that one of the most remarkable ore shoots in the camp has been developed. It is 26 to 28 in. wide. It has been developed now for some distance, and the ore will probably average close to 2,000 oz. In a week's development this orebody yielded 36 tons, upon which it is reckoned a profit of $30,000 can be made. Quite recently at another point along the fault the vein has shown cobalt bloom where before it was quite barren.

The Cobalt Lake has taken a good deal of ore from the vein along the fault, but never anything as rich

tacular as this. While it is not the widest body of high grade ore found in the camp, it is yet one of the widest, and should stimulate interest in the development of the fault on other properties. So far other properties have obtained no profitable results from development along the Cobalt Lake fault.

The La Rose has done a great deal of dead work on the fault. They found the vein to be one or two feet wide, but the silver content of the calcite was altogether too low for mining at a profit. The Right-of-Way also did some development, but without any profitable results. At the other end of the lake McKinley-Darragh at one time had some very encouraging indications, but further development did not bear out this opinion. The development on the Temiskaming and Hudson Bay at their No. 2 camp is undertaken almost solely with a view to prospecting the ground in the vicinity of the fault. So far they have had no results. The discovery on the Lake will certainly stimulate further exploration by all of these companies.

At the northern end of their property the Mining Corporation has developed what is now one of the most important systems in the camp. When they took over the control of the City of Cobalt they found that a crosscut had been run from their shaft near the Buffalo line almost to the Coniagas line, a distance of about 1,700 ft. Proceeding with exploration work on this crosscut they soon ran into this rich vein. This vein has now been developed for 450 ft. to the east and west. It is about 5 in. wide and the wall rock is always rich enough to provide milling rock for the total width of the drift. In one place the area of enrichment was so extensive that the ore has been stoped out for a width of 25 ft. In addition to the main vein, another vein has been developed for some distance to the northwest; this is about 4 in. wide of high grade ore. To the east the drift is being run from the bottom of the winze at the 300 ft. level. The contact with the Keewatin formation comes in the winze at about this level, but the conglomerate is thicker as the drift goes east. The drift is now in good conglomerate under the Cobalt town hall. The strike of the vein is directly towards Cobalt Lake. From the 200 ft. level a crosscut to the south-west has developed a vein of an average width of 5 in. of very high grade ore. In one of the walls a vein 2 in. wide has lately been opened up. The whole system is of the greatest importance, as it has all the characteristics of the orebodies in the camp that have yielded the richest ore, the highest tonnage to the mill and the most permanence. All the ore is drawn back to the Townsite shaft and hand picked and the lower grade treated in the Cobalt Reduction mill.

Bartlett.—A last appeal is being made to Bartlett mine shareholders to save the prospect in Gowganda from being sold for debts. It is stated by Mr. F. R. Hamilton, who writes on behalf of 68 shareholders who are willing to contribute something to write off the indebtedness and work the property, that if 800 shareholders would put up $50 each something might be done. It will be remembered that a week or two ago the Bartlett was put up for auction, but a bid of only $6.000 was made for it and it was withdrawn. Mr. Peter McClaren, who has a report on the property in the circular, states that as far as he can estimate the old management only spent $24,000 in underground mining, although half a million dollars was raised from the public in stock. He points out that there are quite a number of good veins that could be worked on the property, and outlines a scheme of operation if the mine is again to be worked. It is understood that there is an indebtedness of about $40.000 against the Bartlett, and this will have to be wiped out before the shareholders can expect to benefit from any operations undertaken.

E. V. Neelands.—Of unusual interest is the oppointment of Mr. E. V. Neelands of Cobalt to the managership of the Peters mine in British Guiana. Mr. Neelands has been in the Cobalt camp for seven years and he is one of the best known engineers in the district. He came to Cobalt from the West to take over the management of the Hargraves mine, and until that property closed down he remained there. Before the Drummond mine was sold he was instrumental in discovering the possibilities of the mining of the low grade ore, and he has been in charge of the property since it was taken over by the Caribou Cobalt Mining Company. Mr. Neelands will go to South America about the middle of next month. The mine he will be connected with is about 110 miles up the Essequibo river from the principal city of the colony, Georgetown. The trip is made by steamboat and gasoline. At present the property is shut down, but there are excellent prospects of a good orebody being developed. The lowest level is at 400 ft., and it is understood that the property has already produced about $1.000.000. There is a mill of twenty stamps on the property, and as the ore is said to be very free milling, extraction is entirely by amalgamation. Mr. Neelands will be very much missed from the Cobalt camp.

The Mercer Silver mines has started work on the lease which until recently was held by the Gould. It has been determined to sink the old shaft on the southwest of the property from the 40 ft. level to a point where exploration work can most conveniently be undertaken. This old shaft will serve as a basis of exploration on the Gould that has never been explored before. All the work on the Gould before was undertaken on the other side of the lake.

PORCUPINE, KIRKLAND LAKE AND MUNROE TOWNSHIP

Jupiter.—At the annual meeting of the Jupiter mines there will be quite a number of offers for that property to be considered. This annual meeting will be held on September 8th in Montreal. These offers include purchase of control and also the milling of the ore by the company itself at some nearby mills. It is believed that no one offer has yet been definitely accepted by the directorate.

Huronia.—Reports from very reliable sources state that Messrs. Timmins have taken up their option on the Huronia mine in Gauthier township. The option has been extended from month to month, the last period expiring on August 15th. It is now understood that the Hollinger financiers have decided to purchase the control of the company and to work the property. It is also understood that they have taken an option on the two claims which were diamond drilled by the Trethewey, but thrown up. A considerable amount of diamond drilling has been done and it is learned that more holes are to be put down.

Boston Creek.—Cobalt engineers have taken up a very promising claim in Boston creek. The claims under option are known as the Giovazzo. While sampling on the orebody on the surface only gives low values in gold, the quartz is well mineralized, and the orebody where it is exposed is large. It is considered that the gamble is a good one. A small gang of men will be put on to do a little developing.

Barite.—It is interesting to note that the preparations for the shipping of barite from the Premiur-Langmuir prospect on Night Hawk lake are proceeding. Two large barges have been completed at Connaught station, and these will be towed up to within a few hundred feet of the orebody by a gasoline launch. A considerable quantity of the barite ore has been broken and is now ready for shipment. It will be shipped to United States from Connaught station. As far as can be ascertained this is the first barite ore that has been shipped from Eastern Canada.

On the Dobbins claims adjoining Dome Lake, some very promising veins have recently been uncovered. Some remarkable samples have been taken from a few shots in the vein and prospecting is now proceeding with a great deal of confidence.

It is confidently believed that the first run of ore will be made at the Schumacher mill on or about the 25th of this month. All the machinery is in place and nothing is lacking now but a few minor adjustments. Mr. K. C. Pepper, who was with Mr. Houston on the St. Antony mine in Sturgeon Lake, has accepted the post of mill superintendent.

A meeting of the Porcupine branch of the Canadian Mining Institute was held in Timmins on August 16th. About 35 members were present, and Mr. A. A. Cole, secretary of the Cobalt branch, attended and tendered an invitation from the Cobalt branch for the Porcupine members to visit Cobalt on September 16th and 17th. The offer was very gladly accepted. The principal event of the evening was a paper by Mr. A. R. Globe, assistant manager of the Hollinger, on his trip through the West and in Alaska. Mr. Globe made particular reference to the oil flotation process as it is now practised in the West, and also gave some very interesting figures on mill costs and mining, particularly in Alaska in the Juneau district. His notes were for the most part based upon practice at the Perseverance mine. An excellent discussion followed, Messrs. Robbins, Williams, Poirier, Summerhayes, Brown and others taking part. The new executive of the Porcupine branch has undoubtedly aroused much interest among the members in Porcupine, and there promises to be a number of very interesting meetings. The next meeting is to be held in South Porcupine, when it is expected that Mr. Church of the Dome will give a paper on stoping practices at the Dome mine.

NOVA SCOTIA

The outputs of the Glace Bay mines of the Dominion Coal Company in July were as follows:

	Tons.
Dominion No. 1	45,919
Dominion No. 2	80,933
Dominion No. 3	4,596
Dominion No. 4	36,089
Dominion No. 5	11,672
Dominion No. 6	26,487
Dominion No. 7	19,046
Dominion No. 8	39,612
Dominion No. 10	15,075
Dominion No. 11	10,535
Dominion No. 12	36,013
Dominion No. 14	40,933
Dominion No. 15	30,225
Dominion No. 16	21,141
Dominion No. 21	13,824
Dominion No. 22	20,180
	462,240

The largest previous monthly production in the history of the company was 452,270 tons, in June, 1914, so that the tonnages of July are the largest yet recorded by 10,000 tons.

Dominion Nos. 2 and 9 collieries produced between them 120,545 tons, 80,933 tons being from the Phalen seam and 39,612 tons from the Harbor seam. No. 2 colliery, as is well known, has a double hoisting shaft, the output of two seams being worked to the one opening. The combined production of the two seams was 120,545 tons, which is a remarkable performance for one producer. The production of No. 15 colliery and of No. 22 colliery was also the largest yet placed to the credit of these mines.

Although the July production was a record one, it could have been at least 25,000 tons greater but for the restrictions which were imposed by the shortage of shipping tonnage, due to the requisitioning of the company's steamers for Admiralty purposes. The present capacity of the Glace Bay mines for output approaches 500,000 tons per month. The outputs of the Glace Bay collieries for the seven months ending July 31st totaled 2,537,683 tons, comparing with 2,634,577 tons in the corresponding period of 1914, showing a decrease of 96,894 tons. Although the output of the mines during August will again be restricted by a shortage of shipping tonnage, and is being also considerably restricted by a shortage of labor due to the heavy recruiting among the miners, it is probable that August tonnages will exceed those of last year by over 50,000 tons, and indications are that by the end of September the balance of the output will be in favor of 1915 as compared with 1914.

The July output of the Springhill mines was 36,068 tons, compared with 36,220 tons in August last, and for the period ending July 31st the outputs were 235,055 tons in 1915 as against 236,181 tons in 1914.

Statistics gathered by your correspondent to the end of June and published in the last issue of the Journal show that about 1,770 men from the mines had joined the military forces of Britain and the Allies, but during the months of July and August the rate of recruiting has been greatly quickened, as may be gathered from the fact that in Cape Breton alone over 600 men were enlisted in the 40th Infantry Regiment. No great exodus of Italians has yet taken place from the mines, but, under recent mobilization orders of the Italian Government it appears probable that the next two months will see large drafts made upon the Italian workmen at Nova Scotian coal mines. The Russian workmen may also be expected to be similarly affected, although the Russians do not form so large an immigrant class of mine labor as the Italians. The Italians are loyal and steady workers, and their loss will be a serious one to the mining industry. It was calculated that at the end of June about thirteen per cent. of the workmen at the mines had joined the military forces of Great Britain or the Allies, but this figure has now been greatly exceeded, and it will be safe to place it at more nearly twenty per cent.

The miners of Nova Scotia have not only a good record in the matter of recruiting, but they have contributed very heavily to the various funds that have been raised for patriotic purposes since war broke out. The contributions of the workmen of the Dominion Coal Company to the Canadian Patriotic Fund from the inception of the movement last September to the end of July totaled $3,228. This amount is composed entirely of small sums deducted from the fortnightly

pay rolls and does not include larger individual contributions that have been made in various places by the officials of the Dominion Coal Company. The idea of the fortnightly payroll contributions is to obtain the modest sum of ten cents per month per man, and the large amount that has been raised is a useful illustration of the cumulative effect of small amounts when contributed by a large number and spread over a long period. The collections for the month of July made through the pay rolls were $778, and there are good reasons to expect that the monthly amount may eventually rise to $900 or $1,000 per month.

The disbursements of the Canadian Patriotic Fund may naturally be expected to extend over many years to come. While the giving of large amounts by individuals is extremely laudable, this method of raising money appeals naturally chiefly to persons of comparative wealth, and very largely ignores the much greater class of individuals whose wealth is not so great. The method adopted by the workmen of the Dominion Coal Company is a striking object lesson of what can be done in a small way, and if it were generally followed throughout the Dominion it would ensure to the Canadian Patriotic Fund a steady monthly income. The amount of money that can be raised by the collection of small amounts from a large number of contributors spread over a long period is surprising.

In addition to the contributions toward the Canadian Patriotic Fund, the workmen of the Dominion Coal Company are also at the time of writing engaged in making collections for machine guns, and it is expected that the cost of five or six guns will be provided in this way. When it is remembered that a comparatively short time ago the workmen of the Coal Company gathered over $4,000 for relief of the Newfoundland sealing disaster, and that in addition to the two funds mentioned above, they have given out of their earnings to the Belgian Relief Fund, the Red Cross Fund and other benefactions, and have in addition given recruits to the forces of the Empire in greater proportion than the remainder of the population of Nova Scotia, it will be seen that in true patriotism, of both person and purse, the miners are to the fore.

NEW YORK

Confidential advices from trustworthy sources in Germany tend to show that despite the perfect organization and military enthusiasm of the early stages of the war, a tremendous number of the Teutons are feeling rather "sick," and are showing it. Their intensely practical nature doesn't respond properly to the outlook.

American and British manufacturers of asbestos goods have made such successful efforts to capture the South American and other trade in these articles, which was formerly held largely by Germany, that the mining of asbestos in Quebec is on a more flourishing basis than for a long time. Good profits are being made. This condition is all the more remarkable because the asbestos market became extraordinarily depressed when the large German demand was cut off during the early months of the war.

The outlook for prosperity in the iron, steel and ore business becomes more pronounced constantly. The steel industry is operating at over 90 per cent. capacity; even the Alabaman field is reviving, where dullness was especially marked due to the South's financial difficulties regarding cotton.

J. P. Morgan, head of J. P. Morgan & Co., which American banking concern is acting for the British Government in placing war orders, etc., returned to his office on August 16th. He was shot several weeks ago by a German crank. Two thousand people gathered to see Mr. Morgan at closing time, and greeted him with hand-clapping. He had no guard or escort. Morgan & Co. has branches in London and Paris.

Holders of Cobalt stocks are interested in the fact now apparent that the low price of silver is largely due to its extraordinary output as a by-product of western copper mines. According to the Mining and Scientific Press, the annual output of silver by 14 of the largest copper and lead companies in North America is over 100,000,000 oz., while the 14 largest silver companies have a total output of only 21,500,000 oz. The Anaconda Copper Co. at Butte produces close to 11,000,000 oz. annually.

Unusual interest is manifest in Kennecott Copper Corporation, following a visit of its president and Henry Crumb, mining engineer, to the mines in Alaska. Curiosity prevails as to how long the 70 per cent. of its Bonanza mine will hold out. Monthly shipments of ore and concentrates from the company's three mines are now at the rate of about 9,000 tons per month.

Much British gold is arriving in New York from various sources, England, Canada, Australia.

United States Steel Corporation and the majority of the American steel manufacturers have not turned out a single piece of ordnance.

Yukon Gold Co. has acquired control of another dredging property in California, making the fourth Californian dredging property of the company, in spite of which its principal gold yield continues to come from Alaska.

Demands for sulphuric acid from the Allies is causing increased output in this by-product. Tennessee Copper Co. in particular is profiting.

MICHIGAN IRON RANGES

Resumption of activity at the Michigan iron mines is quite general. The Cleveland-Cliffs Iron Co., the biggest operator on the Marquette range, besides restoring the increased wage scale in effect a year ago, has increased forces at a number of its mines. In the Gwinn or Swanzy district, the Stephenson mine (so-called from Senator Stephenson, the lumber king of Wisconsin who owns the royalty) has been changed from four days a week schedule to a six day week. Steam shovels are stripping the Stephenson's large stock pile. The Gwinn or Smith mine, the Northwestern and the Princeton No. 2, other mines of the Cleveland-Cliffs Co. in the same district, have assumed new activity. At the Gwinn mine 180 men are employed four days a week, there being both night and day shifts. At the Northwestern underground development work is proceeding from the concrete shaft which with the standard steel headframe of the company has been idle since construction several years ago, the concrete shaft having been sunk and then sealed with concrete in the bottom, awaiting better times. At the Princeton No. 2, an older mine, sinking is in progress for a new level below the six already contained. At Negaunee, the Cleveland Cliffs Co. has made notable additions to its working forces at the big Negaunee and Maas mines, which are connected underground.

and are known to contain over twenty million tons of good grade ore.

Over 2,000 miners are now employed by the seventeen active mines of the Iron River district. The large stock-piles accumulated during the dull season of 1914 and last winter are being loaded by steam shovel for shipment to Escanoba ore docks on Lake Michigan. Among the new mines to enter the list of shippers are the Bengal of Pickands, Mather & Co. of Cleveland, and the Homer of the Wickwire Steel Co. of Buffalo. The Homer mine was formerly the Donahue Exploration of the Munro Iron Mining Co., also of Buffalo, but was sold by this Rogers-Brown subsidiary to the Wickwire Co. several years ago.

Resumption of construction work on the new steel plant of the U. S. Steel Corporation at Duluth presages the making of steel at the head of the lakes. It is estimated that the plant will be completed early in the winter. Charcoal iron furnaces in the upper peninsula of Michigan, of which there are several, are resuming activity, and in particular are devoting attention to chemical experiments for most profitably utilizing the products of the distillation process of making the charcoal. Since German chemicals have been largely cut off from the U. S. A., this chemical by-product department of the charcoal-iron furnaces, which was just getting into the more complicated branches of chemical manufacture, has become increasingly attractive.

There is no truth in the newspaper story of the intended merger of several of the independent iron and steel companies into a second Steel Corporation under the leadership of Charles M. Schwab and H. C. Frick. The false report had it that the following companies would consolidate: Bethlehem Steel Corporation, Colorado Fuel & Iron Co., Jones & Laughlin, Crucible Steel Co., Lackawanna Steel Co., Cambria Steel Co., etc.

"Iron Ore," published by Geo. Newett of Ishpeming, good-naturedly styles Charles M. Schwab "the American Krupp," on account of his recognized ability, distinguishing him from the run of American steelmen, at manufacturing munitions of war. The Bethlehem Steel Corporation, which Schwab controls and actively manages with headquarters at South Bethlehem in eastern Pennsylvania, conveniently near the port of Philadelphia, is now estimated to be producing enormous quantities of shells.

OBITUARY

Another of the "old-timers" of British Columbia died a few weeks ago in the City of Vancouver, namely, Frederic Soues, for more than 30 years in the Provincial Government service, and not long out of official harness, since it was only two or three years ago that he was superannuated. Details of his varied career have not been obtained, but it is known that before going to British Columbia more than 50 years ago he was in Australia and New Zealand.

The Daily Colonist, Victoria, B.C., recently published the following: "Mr. Frederic Soues, one of British Columbia's most respected and esteemed pioneers, passed away last week in Vancouver. A native of Scotland, he came to British Columbia in 1862, and for 30 years held the position of Provincial Government Agent at Clinton. In the early days the duties of that office were many and varied, extending over a very wide district, but no matter what the personal inconvenience all would receive prompt and courteous attention. The late Mr. Soues was a life-long, faithful friend, a man whose word was as good as his bond, and no one ever appealed to him for help in vain. His name stood for what is best in character, and those who had the privilege of his friendship feel that in his removal one of Nature's noblemen has gone to that bourne whence no traveller returns."

Mr. Soues was always enthusiastic concerning the mineral riches of Lillooet district, and for years he advocated gold dredging on the Fraser river which flows through it, but he did not live to see such operations undertaken on an extensive scale with modern gold dredging appliances. He was well known to the late Dr. Geo. M. Dawson, of the Geological Survey of Canada. Incidentally it may be mentioned that Mr. Robert A. A. Johnston, mineralogist and curator to the Geological Survey, made the following note on the mineral Souesite:

"Lillooet Mining Division, B.C.—The name Souesite was given by Hoffman (G.S.C., Sec. Chem. Min., 1906, pp. 9-11) to a nickel-iron alloy found associated with platinum, irodosmine, gold, magnetite, quartz and garnet in the river gravels about two miles below Lillooet on the Fraser river. A specimen of the mineral so named by Dr. Hoffman was first sent by Mr. Soues for determination."

As indicating the confidence the late Mr. Soues had in the mineral wealth of Lillooet district, the following excerpt from a report of his, printed in the Annual Report of the Minister of Mines of British Columbia, 1896, which was the first official report of the department published after the creation of the British Columbia Bureau of Mines, and the appointment of Mr. William G. A. Carlyle as Provincial Mineralogist. Mr. Soues, in the capacity of Gold Commissioner, wrote of Lillooet under the subhead of Bridge River, as follows:

"Bridge River—I have for years past, notably in 1886 and 1889, endeavored to draw attention to this (in my opinion) the richest, and at the same time most neglected, portion of the district, and may at this time and place be permitted to refer to it at length. . .

"From a personal residence of 34 years in the district, at Pemberton, Lillooet and Clinton, and during the whole of that time with exceptional opportunities of learning the amount of gold obtained and its sources, I may be supposed qualified to deal with the matter intelligently and correctly. With the decade ending 1869 official public reports, with regard to mines and mining in this district, are conspicuous only by their absence. The early miners coming to this province, 1859-60, worked their way up the Fraser river, testing all the tributaries for gold. Bridge river in those years was located and worked, and from that time on to the present by white, Indian and Chinese miners, year by year, with varying success. The richest finds and largest nuggets of gold were obtained in the decade referred to. With the decade ending 1870 we have official mining statistics, commencing in 1874, in some of which annual reports place has been found for Lillooet district and the estimated returns. In others the district has been entirely ignored.

The foregoing is but typical of the consistent attention of the late Mr. Soues to the considerable promise for mining in Lillooet district. Only now is railway transportation being provided, and with the early season road feeders will be established within a few months, and as these give better means of access to the scattered gold-bearing localities of Lillooet there will most likely be gradually realized the expectations of the late Gold Commissioner and others who have thus predicted good returns from mining in this part of British Columbia.

HOW TEDDY McCORK WON BACK HIS CLAIM

By J. Harmon Patterson.

There had been one or two good discoveries of silver on Oswald Lake, and as was usual there had been a great foregathering of prospectors.

I arrived after the first rush, and by dint of much searching had found some apparently good ground, on which I staked two claims and at once set to work prospecting them. In a rush such as this it is necessary to stake with all possible speed. If you waited to make a real discovery, someone might run lines around you while you worked, so I lost no time in getting in my stakes.

Adjoining my claims was one which had a fairly good showing. I soon met the owner, an Irishman named Teddy McCork.

You do not wait to be formally introduced in the wilderness, and Teddy and I became fast friends inside of an hour. As he had no partner and I had none he removed his little tent to the small stream on which I was encamped, and for two weeks we cooked and ate together.

A goodly man to look at was Teddy, tall and straight as an arrow, with a shock of brown hair and a clear blue eye. His smile was contagious. He was very active and strong, and I often thought he would be a dangerous man in a fight.

"I've been offered two thousand dollars for the claim," he informed me one night by the camp fire, but I want a thousand pounds."

"Why the thousand pounds?" I inquired. He went into the tent and came out with a photo in his hand.

"That's why," he replied.

It was the picture of a girl of about twenty and very pretty she was.

"And isn't she the little fairy," he remarked. "No night could be as black as her hair, no sky as blue as her eyes, and the cherries were not more red than her lips. Sure she is the prettiest and sweetest little maid in all Ireland, and if I had that thousand pounds I'd go back to her at once."

"Nothing less than a thousand do?" I asked.

"Her father turned me away as being too poor," was the reply, "but the dear girl promised to wait a hundred years for me."

* * * * *

A prospector is allowed thirty days after staking in which to record his claim. If he fails to do this it is liable to be jumped, that is, restaked, by someone else. If a man deliberately abandons his claim this restaking is not considered anything amiss, but the regular claim jumper is held in great detestation by all prospectors.

Some men are unprincipled enough to take any advantage possible of the error of another, either in staking or recording, with the intent to do him out of his lawful discovery; but the mining laws of the Province, though they may be far from perfect, are justly administered and will not allow any rogue to profit at the expense of an honest but ill-informed man if it can be helped.

Teddy had not recorded his claim, as he was anxious to get in as much work as possible while the weather was fine. As the thirty days were drawing to a close he set out for the recording office alone. He intended first to visit another claim he had staked on his way.

Time passed and Teddy did not return. I was a little anxious, but decided that he would have his claim recorded in any case.

In company with another prospector named Roland, I set out for the recording office, having found sufficient indication of silver to warrant recording my claim. While in the office I thought I would look up the record of Teddy's claim. His name did not appear; but on the ground where his claim should be appeared the name of Daw. I further saw that it had been restaked and recorded.

The date of the staking was sworn on the Saturday before I left. I had been over the claim on Sunday and it had not been restaked, and as Daw had sworn falsely I saw a chance for Teddy. But where was he to be found. I waited all of the next day. Then as Roland was in a hurry and as three other men whom we knew were going in we set out for camp.

* * * * *

The route we had to follow was not an easy one, being a succession of small shallow lakes and bad portages. On one of these we met Teddy.

"Where have you been all this time?" I inquired as we all put down our loads.

"Got lost," was his mournful reply. "I was not very sure of the way, and somehow I got astray and put in six hungry days hunting my way; but I'm out now and will just hustle in and record and be back next day."

"No use," I informed him, "it's restaked and recorded."

Teddy jumped to his feet. "The dirty claim-jumper," he shouted, "who is he?"

"Don't know," I replied, "only his name is Daw."

"That sucker," said one of the men. "Why he jumped a claim on me down in Burke, and I had the assessment work nearly all done, too."

"I'll do my assessment work on his face," said Teddy, wrathfully. "See if I don't. Jump my claim, will he. I'll teach him."

"You didn't record within the thirty days, Teddy," I said, "so that legally Daw had a right to restake, but he swore that he did it last Saturday. Now I was on the claim on Sunday and no restaking had been done. I can swear to it. This will put Daw out. All you have to do is to go in quietly restake the claim, present your certificate, and file a caution against Daw, and I am sure that you will win."

"Me go to law to get my own claim," was his reply, "and then give it to the lawyers. Not I. I'll choke it out of him."

"Suppose he won't fight?" I suggested.

"I think he will," said one of the men. "He's some scrapper himself."

But Teddy didn't care how great a scrapper he was. In vain we warned him that he might lose the claim altogether. Vengeance he would have and his claim as well.

"If nothing but a fight will do you," I suggested, "I'll tell you what I'll do, I'll see this Daw if he is on the claim and try and get him to agree to fight you for it." I said it as a joke; but it was not taken as such. Teddy was most agreeable, and the men thought that Daw should be made to accept.

It was decided that all should go on to my claim, taking Big Mac to referee the fight, and I was to see Daw and arrange it with him amicably if possible.

Along with Big Mac came his partner, both anxious to see the scrap.

"Is your name Daw," I inquired of a pretty husky individual whom I found grubbing away on the claim.

"Name is Daw," he replied looking up. "What of it."

"I reckon you know that this claim belonged to a man named McCork," I began. "He left his recording rather late and on his way into the recording office he got lost. You know the rest."

"Yes," he replied calmly. "I know that this claim was originally staked by one McCork, but as he had not recorded it within thirty days after staking, as required by law, he forfeited all his right and title to it, and it makes no difference to me whether he was lost or hung."

"As it happens," I said, "McCork is an Irishman with a temper belonging to that race and unless you are ready to fight him for the claim I imagine you are in for a thorough licking."

"Wishes to fight me for the claim, does he? He's a fool, and I would be, too, if I agreed to such a crazy thing. I have the claim and am not exactly spoiling for a fight. Still if it's a fight McCork wants I might be able to oblige."

"Do you know," I said angrily, "that with your nerve I would own the whole camp. You chatter away so glibly about the law, that one would be apt to think that it was your best friend; but it has you on the hip this time. You've jumped claims before and got away with it; but you overstepped the mark this time. You swore you staked this claim a week ago to-day, when at the time you were not here at all. You made out your certificate, swore to it, recorded it and then came out here and restaked this claim. Now we will see just what the law will do to a man who will commit perjury to jump an honest man's claim."

"That's not true," he said, but I could see that he was badly scared.

"Very well," I replied, "you've had a real sporting offer made you. If you won't take it you will have a chance to prove your right to this claim in a court of law."

"Wait," he said, "what kind of a man is McCork?"

"As you said a moment ago he is a fool," I replied. "He has the notion that the only reasonable way to settle this matter is to fight it out, and the best man take the claim. He knows that he was at fault; but he also knows that you are absolutely crooked. He is not nearly as large as you are."

"And if I win the claim is mine," he asked, "and there will be nothing more about it?"

"That is his fool proposition," I replied. "The fight will end the dispute."

"And am I sure of fair play?" he asked anxiously.

"There will be fair play all around," I assured him.

"Then bring your man around to-morrow morning," he said finally.

Daw looked mightily surprised next morning at the appearance of seven men, when he had only expected two. He cast many an anxious glance towards Big Mac, but his face cleared when I named McCork.

"These men are all witnesses," I began, "that the winner of this fight is to be the absolute owner of the claim on which we stand, and that neither is to take any action against the other in any way in regard to it."

Everyone agreed that such would have to be the case, and both men expressed the willingness to fight under these conditions.

Big Mac assured them both that it was to be a straight, stand-up fight with their fists. And no one in the crowd was to make a remark till it was over.

The two men then faced each other. For a time they sparred as though to try and learn each other's skill, and it was evident to all that neither of them were novices at the game. Suddenly Teddy's fist shot out and he landed on his opponent's mouth. The blow was not hard, but it hurt. It angered Daw, who struck fiercely in return. Then the fight began in earnest.

It was soon apparent that Teddy was playing with his opponent. Daw was much stronger and his greater reach should have counted much in his favor. But Teddy's defence was perfect, and so quick was he in getting away that Daw rarely reached him. He would circle round and round awaiting his chance. Then he would plant a light blow and retreat. When Daw followed too close he always got punished. So the combat went for half an hour.

Daw at last realized that if he won he must make use of his superior strength. So he decided to force matters. He drew gradually back and as Teddy followed he made a rush. To his surprise his opponent did not retreat, but met him solidly. His mighty right punch was caught on Teddy's left arm, while Teddy's right landed on his chin. The blow dazed him and he dropped his arms.

"Had enough?" asked Big Mac, but he got no reply.

"Go to him Teddy," someone advised.

"Shut up," roared the referee. "The next man to open his head feels my fist."

Daw slowly recovered, but seemed in doubt what to do. Teddy stood ready, and just as the referee was about to call it off, Daw made a rush. Teddy dodged and slapped him smartly on the ear with his open hand as he passed. It was fear of Big Mac only which kept us from laughing.

They faced each other for a few seconds. Then Daw, if he could not fight, knew how to retire gracefully. He held out his hand.

"McCork," he said, "take the confounded claim. You could have knocked me out in the start and I know it."

"Sure," replied Teddy, who had not lost his smile since the fight began, as he took the proffered hand, all animosity forgotten, "I knew that I could whip you from the start; but you gave me a good half hour. Now I promised my sweetheart I'd make fight again only in a just cause, and I've kept my promise."

I invited everyone over to my camp for lunch, and had you seen the happy family demolishing my pork and beans, you would not have believed them fresh from a fight.

* * * * *

Next day Teddy [illegible] and I had no [illegible] recording it. He told it later and [illegible] did not realize the thousand pounds he [illegible] was enough to change the mind of the [illegible] Kaiblees.

MARKETS

STOCK QUOTATIONS.

(By courtesy of J. P. Bickell & Company, Standard Bank Building, Toronto.)

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Alaska Gold	32.00	32.50
British Copper	50	75
Braden Copper	7.37½	7.50
California Oil	301.00	304.00
Chino Copper	43.75	43.87½
Giroux Copper	.50	1.00
Goldfield Cons	1.25	1.31¼
Green Cananea	36.00	39.00
Granby	86.50	..
Inspiration Copper	32.50	32.75
International Nickel	161.00	165.00
Miami Copper	25.00	25.50
Nevada Copper	14.00	14.12½
Ohio Oil	150.00	152.00
Ray Cons. Copper	21.00	21.12½
Standard Oil of N. Y.	188.00	191.00
Standard Oil of N. J.	423.00	430.00
Standard Oil (old)	140.00	..
Standard Oil (subs)	1000.00	..
Tonopah Mining	5.00	5.50
Tonopah Belmont	3.87½	4.00
Tonopah Merger	34.00	36.00
Yukon Gold	22.50	24.00

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Dome Extension	.19	.19¼
Dome Lake	.23	.24
Dome Mines	21.00	21.50
Foley O'Brien	.27	..
Hollinger	24.00	..
Jupiter	.11	.11½
McIntyre	.49¾	.50
Moneta	.07	.07½
Pearl Lake	.00⅜	.00½
Porcupine Gold	..	.00⅝
Porcupine Imperial	.06	.06¼
Porcupine Crown	.70	.74
Preston East Dome	.05¼	.05⅜
P. Vipond	.65	.66
P. Tisdale	..	.02½
West Dome	.08½	.08⅞
Gold Reef	.03	.03½

Cobalt Stocks.

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Chambers Ferland	.12	.13
Coniagas	4.00	4.40
Crown Reserve	.35	.38
Foster	.01	.03
Gifford	.01½	.01⅞
Gould	.01	.01⅛
Great Northern	.02	.03
Hargraves	.01	.01½
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Right of Way	..	.03¾
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Teck Hughes	.06⅞	.08
Temiskaming	.31¼	.32
Trethewey	.10	..
Wettlaufer	.04	..
Seneca Superior	..	.79½
Homestake	.17	.19
York Ontario	.02	.02½

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Spelter, 18 cents per lb.

Lead, 6 cents per lb.

Tin, 40 cents per lb.

Antimony, 40 cents per lb.

Copper Casting, 19 cents per lb.

Electrolytic, 19 cents per lb.

Ingot brass, yellow, 13c.; red, 15 cents per lb.

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Coal, bituminous, $5.25 per ton.

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Furnace coke, prompt, $1.50 per ton.

Foundry coke, prompt, $2.20 to $2.60 per ton.

Aug. 24, 1915—Tin, straits, 33.75 cents.

Copper, Prime Lake, 16.12½ to 16.37½ cents.

Electrolytic copper, 15.87½ to 16.12½ cents.

Copper wire, 17.50 cents.

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Spelter, 12.75 to 12.95 cents.

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14	47⅜	22⅛
16	47	22⅛
17	46⅝	22⅛
18	46⅝	22⅛
19	47⅛	22⅛
20	47⅜	22⅛
23	47⅛	22⅛
24	47	22⅛

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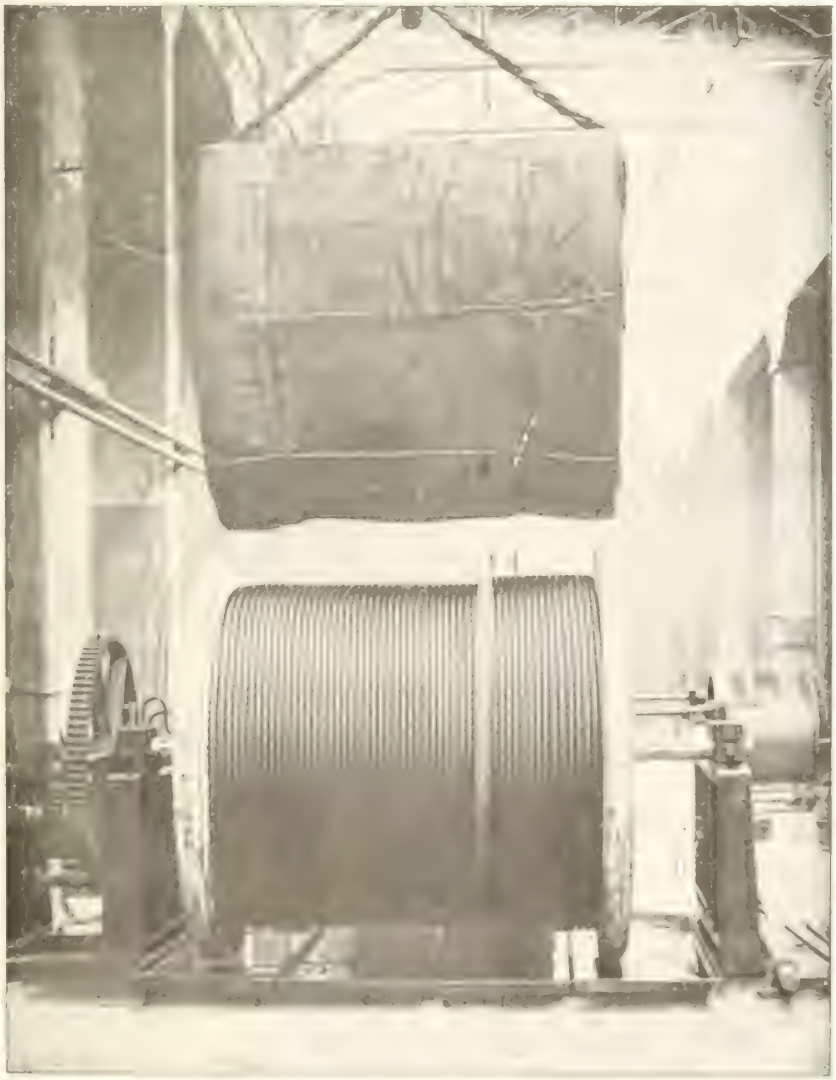

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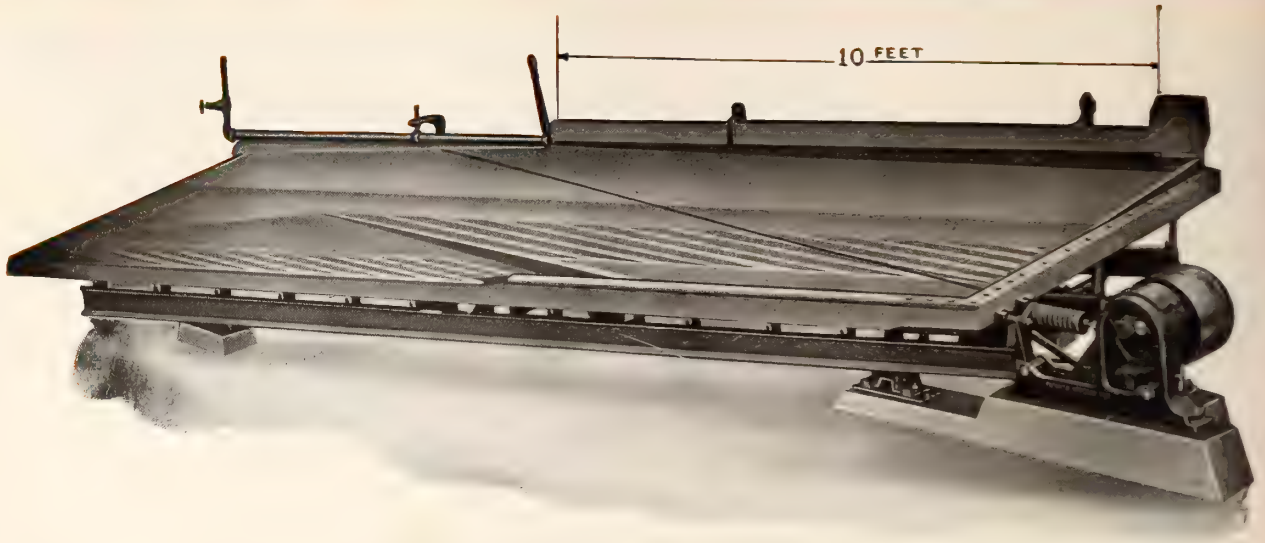

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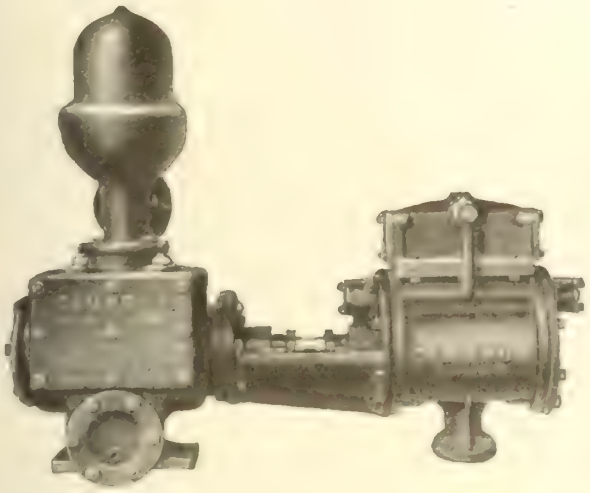

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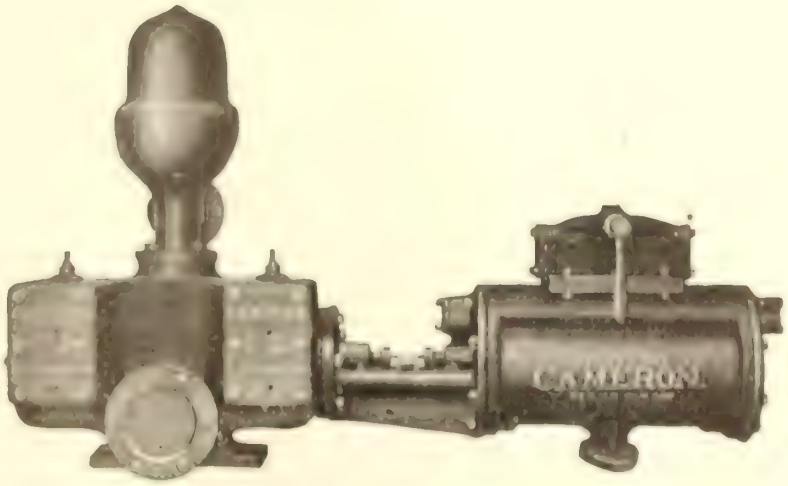

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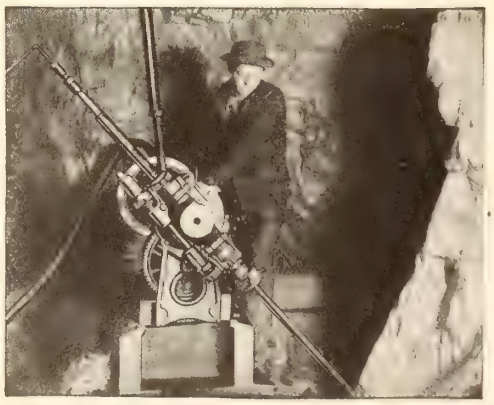

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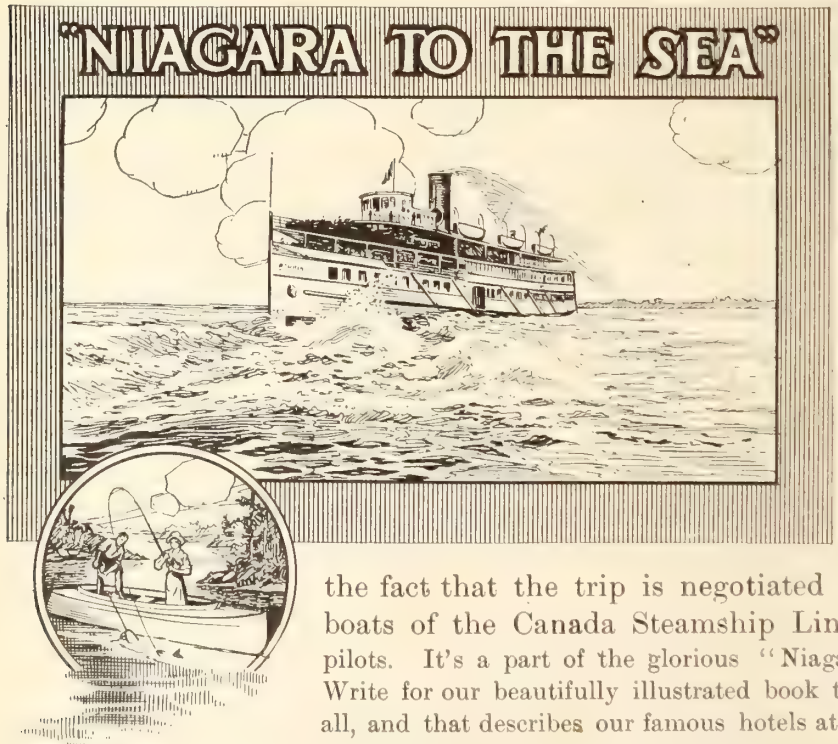

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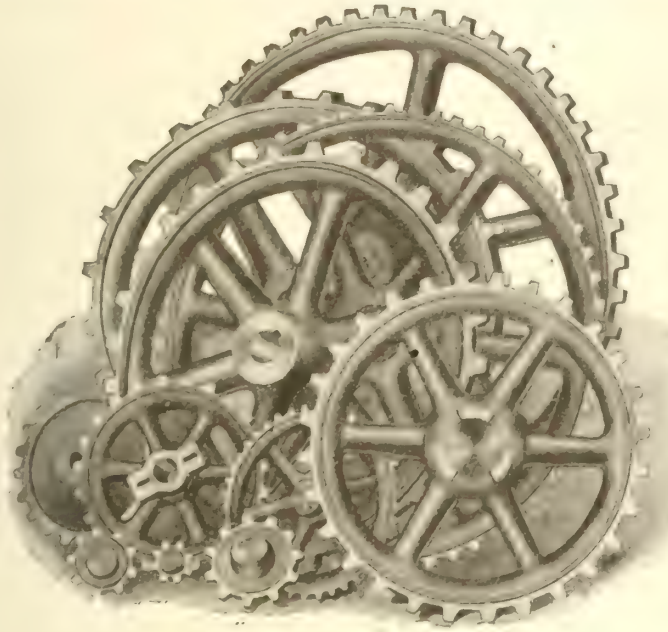

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Application for a lease must be made by the applicant in person to the Agent or Sub-Agent of the district in which the rights applied for are situated.

In surveyed territory the land must be described by sections, or legal sub-divisions of sections, and in unsurveyed territory the tract applied for shall be staked out by the applicant himself.

Each application must be accompanied by a fee of $5 which will be refunded if the rights applied for are not available, but not otherwise. A royalty shall be paid on the merchantable output of the mine at the rate of five cents per ton.

The person operating the mine shall furnish the Agent with sworn returns accounting for the full quantity of merchantable coal mined and pay the royalty thereon. If the coal mining rights are not being operated, such returns should be furnished at least once a year.

The lease will include the coal mining rights only, but the lessee may be permitted to purchase whatever available surface rights may be considered necessary for the working of the mine at the rate of $10.00 an acre.

For full information application should be made to the Secretary of the Department of the Interior, Ottawa, or to any Agent or Sub-Agent of Dominion Lands.

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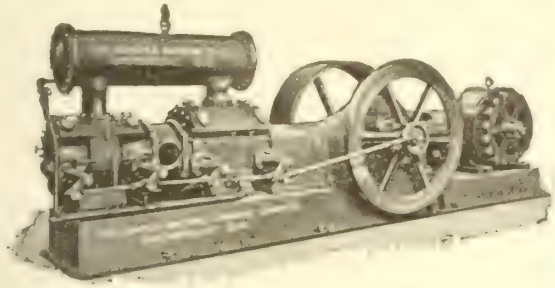

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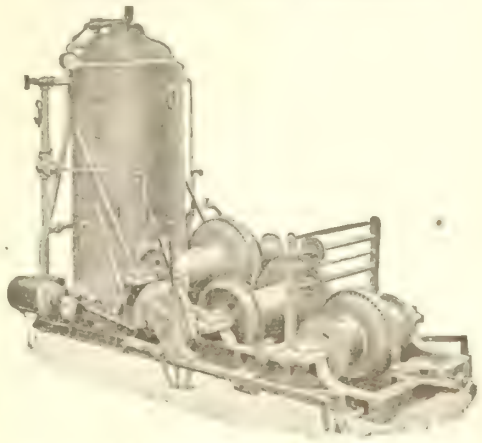

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In what kind of country is it located?
For what is it important?
When was the Cathedral built?
Of what style of Architecture?

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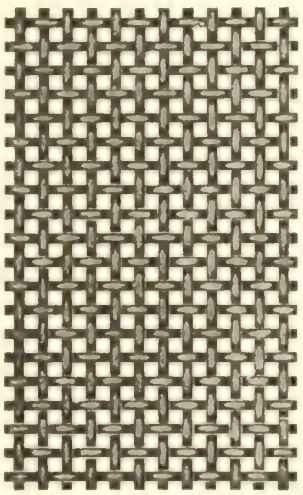

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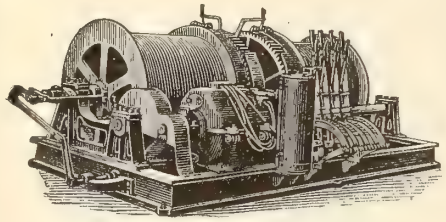

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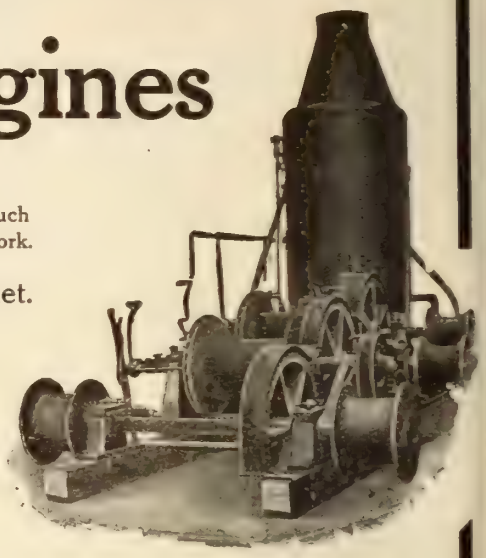

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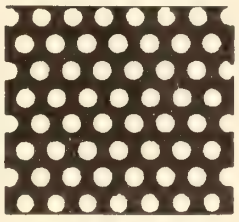

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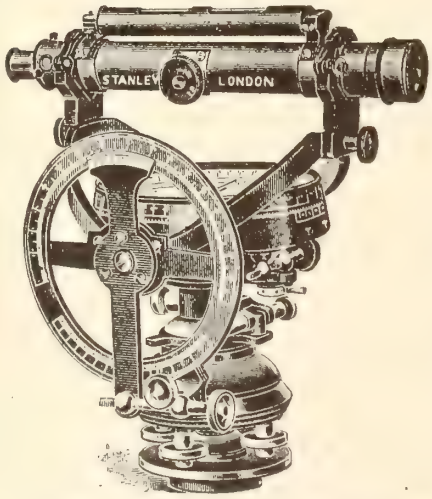

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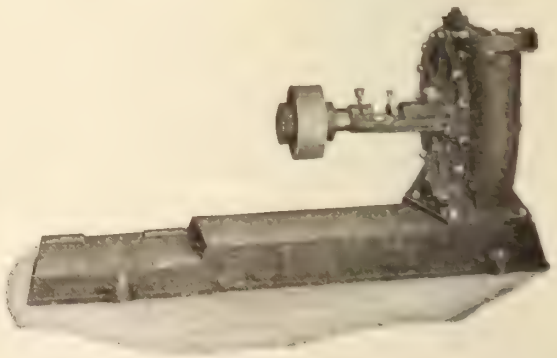

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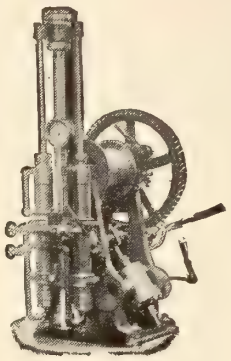

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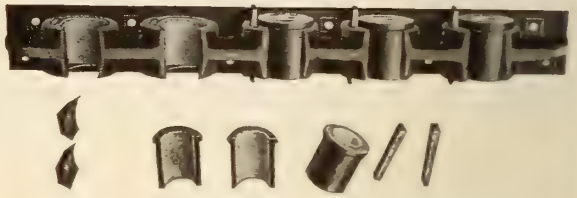

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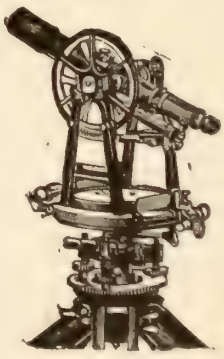

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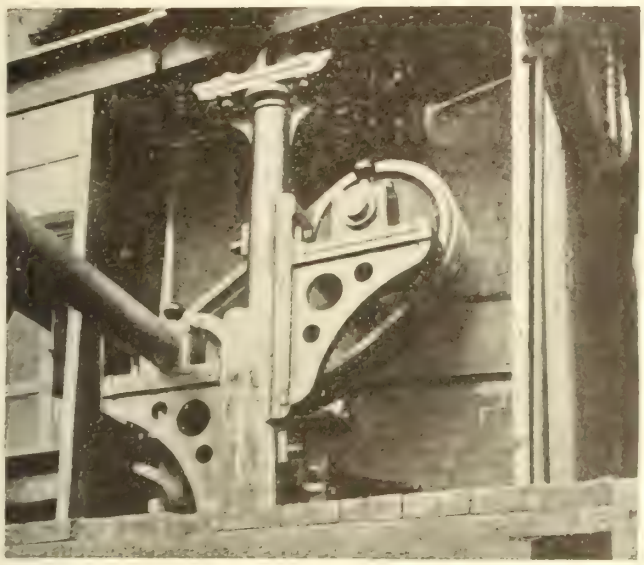

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THE CANADIAN MINING JOURNAL

VOL. XXXVI. TORONTO, Sept. 15, 1915. No. 18

The Canadian Mining Journal

With which is incorporated the

"CANADIAN MINING REVIEW"

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CIRCULATION

"Entered as second-class matter April 23rd, 1908, at the post office at Buffalo, N.Y., under the Act of Congress of March 3rd, 1879."

CONTENTS.

Honor Roll 562

IMPORTANT GOLD DISCOVERIES IN ONTARIO

Prospecting in Ontario has been recently greatly stimulated by two important discoveries. In Munro township very rich gold ore has been found in developing the Dobie-Leyson-Gamey claim. At Kowkash gold has been found in a district which had formerly received little attention.

The Munro discovery, on account of the richness of the ore, is one of the most wonderful yet made in Northern Ontario. The property had been regarded for some time as the most promising in the district east of Matheson on the Temiskaming and Northern Ontario Railway, but its actual value was not realized until recent development work proved that there is rich ore at depth.

Owners of the property have been working quietly and not advertising their success. Mr. A. G. Kirby, of the Dominion Reduction Company, a few months ago acquired the Dobie-Leyson-Gamey claims for interests identified with his company. A shaft was sunk with spectacular results. Ore of phenomenal richness was encountered. Large chunks of ore are, by weight, over twenty per cent. gold. Two thousand ounces of the picked ore obtained by the Ontario Bureau of Mines is estimated to contain over four hundred ounces of gold. Small samples of such ore have been obtained at other Ontario mines; but it is doubtful whether any large chunks as rich as these have ever before been seen in Toronto. It is stated that two small shipments of picked ore made by the company contained about $80,000. It is not surprising therefore that there is considerable activity in Munro township these days.

Another discovery, of a very different nature, has been made at Kowkash, about three hundred miles west of Cochrane, on the National Transcontinental Railway. This is near a district well known to some who have prospected the Onaman iron range; but it had previously received little attention from gold seekers. The occurrence of quartz veins and loose recorded by Mr. E. V. Neelands and by Mr. W. J. Wilson in Government reports, and Mr. Neelands noted that there was a trace of gold in some specimens taken. Now it is stated that Mr. King Dodds, a prospector, has located a small outcrop of rich gold ore. Specimens said to be from this outcrop are quite rich showing considerable coarse gold. So far practically no development work has been done. It is only known that gold occurs on one claim and in small quantity.

The Kowkash discovery has been made in a district which well deserves attention. There are areas of rocks in which gold might be expected to occur, and the transportation facilities are excellent. The National

Transcontinental Railway traversing the district is now in operation. The railway authorities should do all in their power to encourage the prospector, for in no way will the country be more quickly opened up.

In this issue we reprint from Government reports some information which is likely to be useful to those who go into the Kowkash country. The maps are merely sketch maps and should not be depended on too implicitly. However, they will serve a purpose until more accurate ones are available.

The Ontario Bureau of Mines has sent a geologist to Kowkash and it is likely that a geological survey will be made. In the meantime the Bureau is preparing a map which will embody the information at present available.

It is reported that the railway officials are aiding the prospectors by providing facilities for reaching desired points on the railway other than established stopping places. Such a policy is to be commended.

PERSISTENCE OF ORE IN DEPTH

In a contribution to the discussion of a paper by Mr. T. A. Rickard presented before the Institution of Mining and Metallurgy, Mr. G. R. Mickle contends that such discussion should be based on recorded observations, and commends Mr. Rickard for so basing his contentions. But who under heaven would think of using any other basis?

Mr. Mickle contends that some commonly accepted theories have failed and that therefore other theories may be expected to fail. Of course they will. There never was a theory that covered every case.

What are theories based on, if not on recorded observations? Why is a theory accepted, if it does not help us to correlate observed facts? Why are theories discarded, if not because they fail to assist as well as some other theory in correlating facts and making predictions based on those facts?

Mr. Mickle states that because a theory based on observations of air pressure and temperature made near the surface of the earth does not adequately explain phenomena observed at an elevation of seven miles and more that therefore other theories may be expected to fail under conditions other than those in which the observations on which they were based were made. Just why Mr. Mickle chooses a particular example to show that theories have failed is not obvious. There is no more common experience in the study of natural phenomena than that theories developed from observations made under certain conditions do not adequately explain phenomena outside the limits set by those conditions.

What has all this to do with persistence of ore in depth? Frankly we do not think it has very much to do with it. Mr. Mickle has apparently introduced it to explain his dislike for "voluminous discussions of the way ore has been formed and the deductions therefrom which are so dear to the hearts of geologists." He seems to fear that someone will be deluded into believing that the persistence of an orebody in depth depends upon a theory. And as a warning to such persons he cites an example of a theory that does not explain phenomena observed by some meteorologists who sent little balloons, nicely fitted out with barometers and thermometers, several miles up into the air.

We agree with Mr. Mickle that the persistence of ore in depth does not depend upon a theory and we hasten to assure him, and our friend Professor Haultain, that geologists are not endeavoring to prove that it does. They are merely striving to interpret observed facts so that they may correlate them and be in a better position to anticipate development of new orebodies.

While Mr. Mickle's comments on theories and geologists do not favorably impress us, his comments on the recording of observations of persistence of ore in depth do. For various reasons such records are commonly not divulged by operating companies. Many companies do not even make systematic records for their own use. Quite often the information is kept simply in the memory of the underground superintendent. A plea for the recording of observations should command the support of all mining men.

Among those in a position to record observations concerning persistence of ore in depth few have such opportunities as Mr. Mickle. As Mine Assessor of Ontario he obtains pertinent information, and there is no doubt he could give to the mining fraternity some very interesting and useful records if he felt free to do so. Unfortunately the very position which enables him to gather the information does not allow him to make the information public. It is to be hoped that the data gathered will eventually be accessible to all interested in the subject.

We assume of course that Mr. Mickle's desire to exclude geological theories from the discussion of persistence of ore in depth does not mean that he would exclude a record of geological facts. It should be a comparatively easy matter to determine the average number of feet below the surface that ore deposits have been mined. But that when determined would be of little assistance. It has already been established that most deposits do not persist more than a few hundred feet. Would it greatly aid us to know that the average of those which have been extracted was 256 feet or 347 feet? It might satisfy some of our mathematical friends; but it would offer little consolation to the perplexed manager who is trying to decide on the most economical plant and the most economical method for mining an ore deposit which has been only partially developed. What he wants to know is how deep have similar deposits been found to persist. And by similar what does he mean but geologically similar? And if geologically similar orebodies have similar origin, is it not possible that a theory of origin may be of some use in classifying deposits in a way useful to the mine manager?

Theories have their uses though they fail, as facts will fail, to give desired results when in-

correctly used. Persistence of ore in depth does not depend on any theory of origin; but it does not follow that a theory of origin based on observed facts may not be of use in predicting the extent of ore deposits.

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"And this precise occasion 25,000 coal miners of Wales select to strike for a second time, instead of working while negotiating; possibly, if they gain recruits, to tie up communications; possibly to doom thousands of fellow-workmen in the ranks to death for lack of food, or ammunition, or reinforcements that coal alone can bring!

"It is a situation past comprehension, even though Lloyd George's arrangement may have been interfered with by others. The miners know that if that is true the Minister of Munitions and the Government and country behind him can be depended on to see that it is carried out. It is impossible to explain except upon the theory that the miners have not imagination enough to picture, even yet, the war as it affects their country! Can it be that after thirteen months of the most gigantic conflict in history there are still men in Great Britain who have not waked up to the truth? Are there 25,000 in a single trade who do not see what defeat might mean for their fellow-workmen and for themselves?"

The foregoing extract is clipped from the editorial columns of the New York "World" of the 28th August, and gives a new point to the old saying: "They do these things better in France." In Canada we also are amazed, and find it "a situation past comprehension" but our amazement is mixed with deep humiliation that two serious strikes should have been possible in a coal district of Great Britain, upon which, more than upon any other coal field, rests the burden of supplying the navy with coal. A certain extreme section of the miners are credited with a desire to have the coal mines nationalized and their actions are partly explained by wishfulness to force the Government to take over the coal mines as a step as though the Government of Great Britain had not sufficient problems to solve at the present time without tackling the thousand and one difficulties that will arise in nationalizing so enormous a vested interest as the coal industry of the United Kingdom. The British syndicalists do not appear to realize that the very doctrine of syndicalism was born in the fertile brain of Germany's arch-spy Stieber, the man who sowed France with "fixed agents", "agents provocateurs" and every grade of spy before the Franco-Prussian war of 1870-71. The outbreak of "sabotage" and syndicalistic strikes in France at the time of the Agadir crisis was not a coincidence. The simultaneous occurrence of labor troubles in France and the United Kingdom with the periodic sabre-rattlings of Germany during the armed and irksome peace that preceded the present war was too obvious to be explained as due merely to coincidence.

There are faults on both sides in the South Wales labor troubles. Neither the masters nor the men in the South Wales coal fields have in the past been remarkable for keeping faith with each other, and the present absolute distrust between masters and men, combined with the revolt of the men against their union leaders, has its explanation in past acts of bad faith on both sides. Be this as it may, the action of the South Wales miners remains an indelible stain on the otherwise admirable and heroic record of the British miner in the present struggle. Their action is deeply resented by miners in other portions of the Empire. It is an action that will defile the memory of South Wales long after the war is over, and no men will feel the humiliation and odium that these strikes bring to those who have participated in them, more than the gallant Welsh miners who are bravely bearing the leek in the far-scattered fields where Britons are at death-grips with an, as yet, unbeaten foe.

The demand for munitions of war is making itself felt in many ways in the mining industry. Most metals are greatly in demand and the prices good. Big premiums over these prices are also obtainable for especially pure materials. It is not surprising therefore that many new metallurgical works are being established. As a result of the peculiar conditions, Canada is soon to have in operation three zinc refineries, using electrolytic methods. The treatment of zinc ores by leaching and electrolytic precipitation from sulphate solutions gives a product now much in demand. The process could not have been adopted before and with any such promise of success. If reasonably good results are obtained the electrolytic process may prove the salvation of many Canadian zinc properties.

Porcupine continues to make new records. Hollinger and Dome mines the largest producers, each milled over 28,000 tons in August. The joint output of the two gold mines is now about $13,000 per day. Some Mining Porcupine Crown and Vipond mines while not such large producers are making good profits.

Remember the Dominion Fund for disabled soldiers. Mr. E. H. Scammell, 22 Victoria Street, Ottawa, is secretary.

RESUMPTION OF CHROME ORE MINING AT BLACK LAKE, QUEBEC

By A. C. Allenson.

The little town of Black Lake, Quebec, like most mining communities, has had its ups and downs, in the course of its short corporate existence. A lumberjack's camp and river driver's headquarters in the beginning of modern things, then fireswept a quarter of a century ago, its woods destroyed, its houses with one or two exceptions in ashes, it has possessed vitality sufficient to rise superior to its misfortunes. Then the miner entered, some farm lad of more than ordinary perspicacity who seeing the silvery glint of the shining rock fibre was curious enough to examine it, pick its cottony fibre, twist it in his fingers, and perceive that it might have its uses. After the usually described difficulties of mining beginnings, which are a testimony to the romantic inclinations of the average person, perception led to enquiry, enquiry to a discovery of uses, and the plough knew the local Columbus no more. He had entered the school of magnates, where he still abides in strength and opulence.

For more than a quarter century the asbestos business steadily grew and developed in the hands of independent owners, and in the Asbestos Club Room of Black Lake are to be seen curious old photographs of men of mark who had their beginnings in a hole in the ground on the hillside facing the station, and about them linger traditions and stories that grow more and more wild and romantic as the years go by and the tales are told. Now the business is much more decorous and frilled, if less interesting and romantic, and the rough and ready mining of bygone years has led to the carefully and scientifically crushed, milled and graded article of to-day.

Then came the mergers, "Wheresoever the carcass is, there will the vultures be gathered together." The quotation may be a little harsh, but it illustrates the situation. Whether the coming indicated evolution or degeneration, social, political or personal bias decides to a great extent. At any rate, for a short, brilliant day Black Lake and Thetford Mines were very much on the map of the financial world, and plumed themselves greatly on their advent. They remain on the map to this day, but their names in connection with asbestos do not shine with the old time effulgence. Like the good seed planted in sparse earth they as quickly wilted as sprang up. Asbestos is still produced in large quantity, and prices are still good, and the two towns will one day recover from the wounding they received in the house of their friends; but the mauling was a severe one. It will take a quite new kind of financial wizardry to put through the next merger, which, we are sometimes told, will embrace the entire asbestos field and put a worthy and excellent industry where it ought to be, in the most respectable of company, and not that of the disreputable, cadging down and outs.

The war has, of course, stopped the great outflow to Germany, one of the biggest consumers of Canadian asbestos in ante-war times. Doubtless while Italy was on the fence quite a lot of asbestos filtered through via the United States, but not much gets there in these days. The States are large buyers and a considerable quantity goes to England. For the best grades the prices are as good as ever they were.

While the market for the highest qualities was never better, the demand being excellent at top figures, there is more difficulty in getting rid of the inferior grades, freight being very high, so much so as to make shipment of cheap grade stuff almost impossible. The railway to Sherbrooke makes an even split of the rate to Boston or New York. It may be that after the war the manufacturing side of the industry may be developed more locally.

Labor difficulties have clouded the Asbestos Corporation's work recently in Black Lake. The reduction of wages from $1.75 to $1 in winter and $1.25 in the summer months has brought about a shut-down of their mines and mills in Black Lake. The men quit and are not likely to resume while there is more remunerative employment within reach. It may be that wiser counsels all round may prevail during the coming weeks and a satisfactory compromise be effected. A certain amount of local grievance has been caused by the employment of alien foreigners in local pits, while the native-born are shut out. Certainly the number of Austrians employed has been considerable. Many of the men have gone west harvesting. A few have enlisted, though Black Lake has not a distinguished record in that matter, and there has come a side wind of prosperity to help over troubles that otherwise might have become acute.

The shutting of the asbestos mines and mills was a serious thing for the little town that has expended large sums in municipal improvements, but the wind has been tempered to the shorn and skinned lamb. Ten or more years ago Black Lake had another industry besides asbestos. Canadian or Black Lake chrome was then shipped in large quantities to the great steel mills of Pennsylvania and elsewhere, and besides being an essential element in steel making, was largely used in leather tanning, stove lining manufacture, dyes and colors. The industry died a natural death a decade ago, not that its local supply was exhausted, but because of the competition that rendered the business unprofitable. Turkey and Greece shipped chrome ore in ballast to American ports, and large quantities of high-grade ore came from Rhodesia. Before this competition Canadian chrome dropped from the market. With the advent of war, that ill wind blew some good to Black Lake. The Sick Man of Europe became still sicker in the Dardanelles and elsewhere. Greece with King Constantine's shifting feet, and Queen Sophia busy answering her Imperial Brother's prophecies as to the intentions of "Me und Gott," let chrome go by. In South Africa General Louis Botha was attending to the cleaning of sundry Teuton blots on the local map, and chrome was shelved there for a time. Moreover, there are not many tramp ships about the ocean now. The British are busy on Imperial business, and the German-owned boats are cultivating cobwebs in Hamburg, Hoboken and many another sheltered haven, waiting for the clouds to roll by, while the Kaiser sings mournful dirges about the freedom of the seas, Teutonic version of the same. There is no South African chrome coming to the States, so Black Lake can afford to turn away its gone-wrong-one-best-bet asbestos to something at least temporarily better.

Since the close of June over 3,000 tons of chrome has been shipped locally, and this is but the beginning of the output. Prices are high and are steadily mounting. The old discarded dumps, being of low grade stuff, reckoned valueless these many years, have been eagerly

shovelled up and shipped away at very remunerative figures. The old dead mines are all open again, and every landowner, farmer, and amateur prospector is travelling across lots in both ways to hoped-for fortune. Mr. J. M. Johnston, one of the old chrome pioneers is operating the Ross Mine. The Dominion Mining and Quarry Company, a New York and Toronto corporation, has the Montreal pits and is buying besides. The Beebee properties at Lake St. Francis and Coleraine are open again and in full blast. Mr. David Wilson, a shipper in former prosperous chrome times, is into the work again. The Black Lake Consolidated Co. is mining on its own properties. The Captain Prideaux Pit is being operated by Mr. Woolsey, and Reid's chrome pits are also being worked. Mr. P. E. Beaudoin has opened pits and is shipping largely from his Lakeside properties. Within three months every reachable chrome property has suddenly burst into redhot activity, and while the war lasts, at any rate, there will be bonanza times in Black Lake chrome. Railway sidings have been built or re-established at Black Lake Station, Lakeside, Chrome Siding, Coleraine and other places.

ZINC PRODUCTION IN BRITISH COLUMBIA.

On August 27 the Daily News, published at Nelson, British Columbia, printed the following information relative to the production of zinc in West Kootenay district of that province:

A comparative statement of the shipments of zinc ore and concentrates for the month of July, 1915, and the corresponding period of 1914 shows that there has been a considerable decrease in output this year. It is pointed out, though, that during July of last year both the Slocan Star and Standard mines made extra large shipments, the former having sent 468 tons and the latter 777 tons to Bartlesville, Oklahoma, for treatment. It is also claimed that the prevailing high price of zinc has enabled mines in the United States to so increase their output that the reduction plants have been running to capacity and contracts for Canadian concentrates have been refused.

This condition, however, it is said, has not prevented work from being continued on a large scale at the mines shown in the following list, or at other properties where zinc-bearing ores occur, and it is reported that comparatively large quantities of concentrates are being accumulated at the mines pending the closing of contracts for sale of this product. It is expected that several satisfactory contracts will soon be made, and it is estimated that afterward some record breaking shipments will be made from Kootenay district. Shipments during July of 1914 and 1915 respectively, are shown in the following comparative table:

Shipping Mine.	July, 1914.	July, 1915.
Ainsworth Mining Division—		
U. S.	40	
Utica	40	
Whitewater (J. L. Retallack & Co.)	..	40
Slocan Mining Division—		
Hewitt (Silverton Mines, Ltd.)	138	
Lucky Jim	..	160
Rambler Cariboo	160	
Slocan Star	468	
Standard	777	
Surprise	..	252
Nelson Mining Division—		
H. B.	..	500

AMERICA TO GERMANY

We wait with a clenched and inheld breath
And leash on the pulse of our soul;
You've flung us your fragment sketch of death.—
We await the details of the whole!

Familiar the seascape of your art,—
Of the hull that goes shuddering down,
Of sea-field strewn in the wake of your dart
With the humans that helplessly drown.

Not novel at all,—save westward prow
Of a shell-emptied ship; and thereby
Your earlier shooting echoes now
Your excuse and your motive a lie.

Yet still with a patience grim we wait
(Who wait vain for our own to return)
Till each line of circumstance lie straight,
And each shade of your sinning we learn.

For such and so the minutiae
(And OUR heart holds the heed of the law)
Of the code that quaintly rules the sea,—
And our case shall be clean of a flaw.

Lest there be screen of law's niceties
And behind it your periscope skulk:
The wreck-strewn sea shall we scan for these
Where it tosses o'er side-shattered hulk.

And wait with a clenched and inheld breath,
And a leash on the pulse of our soul,
And look, for your rounded tale of death,
Where the strewn billows slumberous roll!

—Boston News Bureau Poet (B. F. Griffin).

U. S. SPELTER PRODUCTION FOR THE FIRST SIX MONTHS OF 1915.

The production of spelter for the first six months of the year has been canvassed by C. E. Siebenthal, of the United States Geological Survey, with the following results expressed, in short tons:

The output of spelter was 207,634 tons made from domestic ores and 8,898 tons from foreign ores, a total of 216,532 tons, as compared with 177,991 tons for the preceding six months, and with 175,058 tons for the first six months of 1914. In addition there was produced by distallation from drosses and skimmings 13,546 tons of secondary spelter, as compared with 10,273 tons, the half of the 1914 output of distilled secondary spelter. No statistics were obtained of the spelter produced by remelting skimmings, drosses, etc., and [illegible] tons. The total output of spelter from both ore and skimmings was therefore about 242,000 tons, or at the rate of 484,000 tons per year. The whole number of retorts in operation in June is about 12,000, but many of these retorts had been but recently put in operation. Additional retorts to the number of over 2,000 have since been completed are under construction, or are planned.

The apparent domestic consumption for the six months period was 240,096 tons, as against 149,162 tons in the preceding six months, and 149,306 tons in the first six months of 1914. The stocks on hand at smelters were 5,884 tons, an average of about 150 tons for the whole reporting.

The amount and cost of repairs, value of labor, of materials, miners' wages, prices and methods employed will be distributed in short [illegible]

NEWFOUNDLAND'S IRON MINES

By P. B. McDonald.

Newfoundland has two great iron-ore mines situated off its storm-beaten east coast. They begin on Bell Island, a small island 12 miles by 2 miles in Conception Bay and extend for nearly 2 miles out under the ocean. In 1913, the two companies shipped 1,511,502 tons of ore, of which, in round numbers, one million tons went to the owners' furnaces in Nova Scotia, two hundred thousand tons went to the United States, largely through Philadelphia, two hundred tons went to Germany, passing through Rotterdam, and one hundred thousand tons went to England via Middlesboro on the east coast. A total of 13,000,000 tons has been shipped, of which over 2,000,000 tons was to the United States and 3,000,000 tons to Europe.

Bell Island is 13 miles, as the crow flies, from St. Johns, the capital of the colony, about 35 miles by water; it is conveniently situated in the North Atlantic, about midway between European and American ports. To Philadelphia from Bell Island is 1,240 miles; to Montreal, 1,075; to Liverpool, 1,966; to Rotterdam, 2,294 miles; to Sydney, Nova Scotia, 412 miles.

The ore is a non-Bessemer, red, oolitic hematite of hard, blocky appearance. Average analysis of 40 cargoes totaling 220,000 tons, shipped to Philadelphia during 1910, gave 53.71 per cent. iron, 2.31 per cent. moisture, 0.868 per cent. phosphorus. The silica runs from 7 to 15 per cent., being 7 to 9 per cent. in the "Scotia" bed and 10 to 15 per cent. in the lower bed. A typical analysis gives sulphur 0.018 per cent., manganese 0.65 per cent., alumina 3.55 per cent. Among purchasers of the ore have been Bethlehem Steel Co. and the Krupps, of Essen, Germany.

The ore seams outcrop on Bell Island and supposedly in a great elliptical basin on the bottom of the ocean. They are interstratified with fossiliferous shales and sandstone of Lower Ordovician age; like the deposits of Red Mountain, near Birmingham, Alabama, but unlike the Lake Superior deposits, the ore is thought to be a primary deposit, essentially the same as when formed. From Bell Island, the ore dips at 8 to 14 degrees out under the sea. Of the six different seams only the three uppermost are being worked; these outcrop for three miles along the northern shore of Bell Island. In the land areas, the lower or "Dominion Bed" is about 12 ft. thick, the upper about 4 ft., and the third, or Scotia bed, is 7 ft. At depth the ore beds get thicker and somewhat richer than at the outcrops.

E. C. Eckel and Edwin E. Ellis, mining engineers and authorities on the estimation of ore deposits, testified in 1913 at the Government suit against the United States Steel Corporation concerning the tonnage of iron ore at these Newfoundland mines. Averaging the aggregate ore thickness at 30 ft., they estimated 3,500,000,000 tons of ore to exist under the sea within five miles of Bell Island, while slopes from the mainland might tap an equivalent tonnage. The proportion of ore economically and safely recoverable was put at 50 per cent.

It is interesting to note that the outcrops of the ore were at first judged in the early days (without adequate examination) by reconnaissance geological surveys to be "bright, red sandstone." Fishermen used blocks of the ore as anchors and ballast for years without knowing its value, and more or less of it was used for building and miscellaneous purposes.

The first shipment was made on Christmas Day, 1895, by the Nova Scotia Steel & Coal Co., the cargo being taken to Ferrona, Nova Scotia. In 1899, this company sold a portion of its ore holdings to the Dominion Iron & Steel Co., another Canadian company which uses practically all of its ore output at its furnaces in Nova Scotia. The Nova Scotia Steel & Coal Co., controlling now 83½ square miles, uses considerable ore at its Nova Scotian furnaces, but makes a practice of selling ore in the open market.

Mining Methods of Nova Scotia Co.—Mining is by room-and-pillar system, and extraction will ultimately be about 50 per cent. The stopes in the submarine areas are carried on by back-stoping, a portion of the ore being left to stand upon, due to the thickness of the deposit; the foot-wall is at such a shallow angle that the stoping method is rendered comparatively simple. The roof, generally of sandstone, is firm, and ordinarily no timber is required in the rooms, some timber being used in slopes and main drifts. Levels are 250 feet apart.

Power rock-drills are used, and underground electric "steam-shovels" load the broken ore in the stopes very satisfactorily. Experiments proved that the regular type of steam-shovel modified for electric, underground work was best adapted for this. The shovel has an overall height above the rail of 12 ft., and is designed to turn completely around in a radius of 25 ft. A shovel of this type has loaded 350 tons in a shift.

Strange to say, those mines under the Atlantic Ocean are uncommonly dry. Only a small amount of water is pumped by six-stage, centrifugal pumps, electrically driven by direct-connected motors. The pumping is done in two lifts, storage dams being provided near the bottom of the mine and again at a point 4,200 ft. from surface.

Ventilation is by a motor-driven fan of 80,000 cu. ft. per minute capacity at 8 in. water gauge, overlying the slope.

The slopes (or shafts) are driven double, one slope being for hoisting and the other for air; a rock pillar divides them.

Underground haulage is as follows: The cars when filled are pushed by the loaders from the working face to the headway where they are lowered by an electrically-driven haulage engine and allowed to run back upon the level, where they are collected in trips. Then, still controlled by the level-engine rope, the cars are run out, a number at a time, to large storage bins over the hoisting slope. The loading of the skip is accomplished with great rapidity; a series of chutes spaced close together feed from two sides at once.

One of the hoisting engines at the "Scotia" mines is a large one, one of the largest in British America. It is first-motion, duplex, Corliss valve, built by Fraser & Chalmers, of Erith, England. It has cylinders 28 in. by 60 in., equipped with a 11-ft. drum with steam-operated post-brakes, Whitmore overwind device and space for 10,000 ft. of 1⅛-in. cable. There are two drums which lock together for hoisting in balance. The skip is of 45,000 lbs. capacity; they operate in balance. The slope track has an average grade of 16 degrees and is laid with 80-lb. rails. A hoist takes one-half minute.

Some hand picking of the ore is ordinarily done on a steel conveyor belt on surface, previous to crushing in gyratory crushers to 4½ in. size. More picking then ensues on a rubber belt 150 ft. long inclined at 17 degrees. From this picking belt the ore falls into a bin for loading into cars for transporting two miles across

Bell Island to sheltered anchorage. This surface tramway is a two-track, 2 ft. gauge, endless cable system, with 28 lb. and 18 lb. rails and 1 in. cable. The tramway is operated by a compound, condensing steam engine of 125 h.p., geared to give a cable speed of 350 ft. per minute, and situated at the pier where coal is convenient. This tramway can handle up to 4,000 tons per day; the cars are of steel, 1.8 tons, or 30 cu. ft., capacity each. At the piers there are two storage pockets constructed in natural ravines in the abrupt 200 ft. cliff, of 25,000 and 40,000 tons capacity respectively.

From the lower pocket at a point slightly above high water level, an inclined bucket conveyor takes the ore to the loading chute, feeding into a steamer's hold. There are two shipping piers, one of timber, one of steel. Steamers carrying 12,500 tons have been fully loaded in 3½ hours. Electric power for the mines is generated in a power-plant at a wharf near the piers where coal can be handily obtained from steamers.

Stockpiling in winter is accomplished at a cost of less than 1 cent per ton by a device which can handle up to 1,500 tons per day. A side-dump car is run up an inclined track of 20 degrees (where it automatically dumps) by a main-and-tail rope system. The stockpile assumes the form of a triangular pyramid. Progress ahead is achieved by moving (by the engine) from time to time the wooden frame which supports the track a couple of car lengths ahead of the pile. Shipping of the stockpile in summer is done by a drag bucket on a wire rope, rather than by steam shovels. Although perhaps not so cheap, it suits the occasional nature of the work.

Between 1,000 and 2,000 men are ordinarily employed by the two companies on Bell Island. Labor is low-priced, fairly efficient and English-speaking. Bell Island is a pleasant spot in summer; a wild, stormy place in winter.

FRENCH'S ZINC ORE REDUCTION PROCESS.

A press despatch sent out from Victoria, British Columbia, on August 16, stated that on that day Mr. R. F. Green, M.P., headed a deputation of local directors of a company formed to try and establish a smeltery at which would be used the French electrolytic process for treating zinc ores, which deputation waited on Sir Richard McBride, Premier and Minister of Mines for British Columbia, and asked for assistance from the Provincial Government. The process, it was claimed, had already been demonstrated on a small scale at the Trail smeltery and at the Standard Silver-Lead Co.'s concentrating mill at Silverton, Slocan lake, but in view of the pressing demand for zinc it is now thought timely to attempt experiments on a more comprehensive scale. It was urged upon the Government that arrangements be made so that a small unit might be erected at Nelson. The promoters have every confidence that this small unit would show that the process can be made a commercial success. The Premier promised that the request for assistance shall have careful consideration.

In this connection, the following from the Kaslo "Kootenaian" is of interest:

"The parties in Nelson, headed by J. O. Patenaude, who are pushing the French process for zinc reduction, are petitioning Sir Richard McBride for a Provincial grant of $50,000 with which to fix up the Fairview plant for the handling of zinc ores by the French process. The petitioners go on to say:

"French's Complex Ore Reduction Co., Ltd., a company duly incorporated under the laws of British Columbia for the economical production of zinc, has satisfactorily demonstrated the commercial success of the process used by the company for the production of zinc, and in so doing has expended about $40,000.

"The Government of British Columbia is the owner of a plant in Fairview, adjoining the city of Nelson to the east, which can be used by French's Complex Ore Reduction Co., Ltd., with certain alterations, for the production of zinc in commercial quantities by an initial expenditure not to exceed $50,000.

"Arrangements have already been completed in the city of Nelson for special financial assistance to enable the Reduction Company to proceed, provided the alterations necessary to the Fairview plant are first made.

"Your petitioners humbly request, therefore, that your Government will guarantee a sum not to exceed $50,000. . . . . to be used solely for the purpose of installing the requisite machinery and making the necessary alterations to the Fairview plant above referred to, etc."

The "Kootenaian" adds the following comment: "E. Dedolph, who was connected with, and took an important part in the work that was done by the French Government in attempting to solve the problem of electrical zinc smelting, the later experiments having been carried on at the Fairview plant, is not in favor of the scheme outlined above, since it means that all the apparatus that he installed at Fairview at a considerable outlay of Dominion Government money, will be torn out, and further work along the lines which he advocates, and which he claims were about successful, will be out of the question."

Result of the French Process Test.

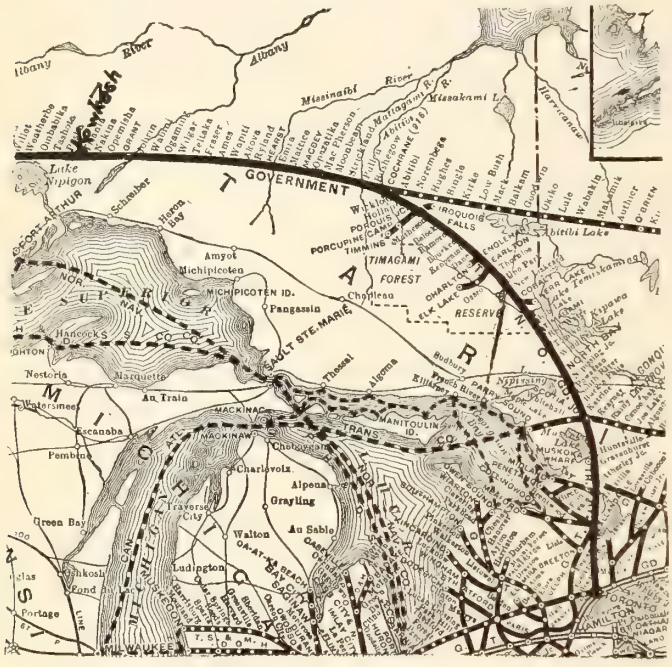
The following excerpt from the published report of the Nelson Industrial and Natural Resources Committee, presented at a meeting of the Nelson Board of Trade about two months ago, is also of interest:

"General results from the operation of the experimental plant for the treatment of zinc ores by the French process at the Standard Silver-Lead Mining Co.'s mill at Silverton, Slocan, have been announced. The ore treated was tailing from the concentrating plant, running from 25 to 35 per cent. zinc, with small value in silver and lead. The extraction made was 90 per cent. of the zinc content. The residue was 45 per cent. in weight of the original ore, so that the consequent enriching in silver and lead and the elimination of nearly all the zinc left it of sufficiently high value to be treated at a smeltery, with returns to the shippers. As the ores treated could not have been shipped to a smeltery with profit, the establishment of a plant of commercial size would apparently bring into value a large quantity of zinc ores valueless under present conditions. The committee is informed that steps are being taken to bring about the construction of such a plant, with an approximate capacity of 100 tons of zinc a day, requiring a supply of about 500 tons of ore, which the promoters estimate can easily be secured."

The recently issued Fifth Annual Report of the Canadian Branch of the St. John Ambulance Association shows that among the members of the General Council of that organization is Mr. S. S. Fowler, of Nelson, B.C. Mr. Fowler was a delegate from British Columbia to the annual meeting of the association held in Ottawa last March.

CANOE ROUTES AND GEOLOGICAL FEATURES OF KOWKASH DISTRICT, ONTARIO

A geological reconnaissance of a portion of Algoma and Thunder Bay districts, Ontario, was made in 1903-4 by Mr. W. J. Wilson, of the Geological Survey of Canada. Those who go into the Kowkash district should provide themselves with a copy of his report.


Albany River
Albany
Kowkash
Missinaibi River
Missisakami L.
Harricanaw
Lake Nipigon
Schreiber
Hurkett bay
GOVERNMENT
RAILWAY
TIMAGAMI FOREST RESERVE
Amyot
Michipicoten
MICHIPICOTEN ID.
Pangassin
Chapleau
SAULT STE. MARIE
Hancocks
Nestoria
Marquette
Au Train
Watersmeet
MACKINAC
MANITOULIN ID.
Escanaba
Fembine
Charlevoix
Alpena
Grayling
Traverse City
Green Bay
Walton
Au Sable
Ludington
Oshkosh
Portage
Abitibi Lake
Temiskaming
Nipissing
Algoma
Thessal
Budburst
Killarney
Iroquois Falls
Porcupine
Timmins
Swastika
Kirkland Lake
Cobalt
Englehart
Charlton
Elk Lake
Gowganda
Hudson
Burwash
Cochrane
Moosonee
Hughes
Burgis
Kirkle
Long Bush
Mattagami R.
Abitibi R.
Matagami
Lake
Wabakimi
Wabasquasi
Ogoki
Auther
Osnaburg
Kenogami
Pagwachuan
Nagagami
Kebinakagami
Wabinosh
Wabakimi
Wabigoon
Trout
Lake
Agimak
Wigwas
Jones
Rapid
Rivers
Bond
Lake
Ogoki
Opimmibis
Opapimiskan
Kenogami
Wilson
Trout
Lake
Fraser
Jones
Rapid
Rivers
Bond
Lake
Hunter
Island
Macoby
Mattagami
Matachewan
Mountain
Portage
Mine
Mine
Mine

p. 138. For two miles below Kawashkagama lake the river is broad, with slow current. At this distance a portage leads to Wawong lake. Below this portage the river is from one and a half to two chains wide, and fairly deep. Between the portage and Rupert fall—a distance of eleven miles—there are only two rapids, and these can be run with loaded canoes at ordinary water. There is a good portage at each.

At Rupert fall there is a drop of fifteen feet over much broken and disturbed ledges of dark green hornblende-schist dipping 70 deg. S.40E. Past this fall there is a five chain portage on the north bank. The river continues in a northwesterly direction for twenty-two miles and is about two chains wide. It then flows northeast for four miles, when it turns almost due north and flows in that direction to Abamisagi lake. Between Rupert fall and Amabisagi lake there are two portages, the first to pass a log jam near the bend, and Howard fall four and a half miles farther down.

Howard fall is caused by a ridge of chloritic hornblende schist through which the river cuts, making a narrow canyon-like gorge fourteen chains long. This gorge is from twenty to thirty feet deep, and the water descends in steps and slides varying from one to five feet. The fall would make a splendid water power. From Howard fall to Abamisagi lake, eleven and a half miles, there are three rapids, two of which require short portages.

The river is from two to three chains wide, with slow current. It enters Abamisagi lake from the south, and turns round, as the Indian name of the lake implies, and flows towards the south for a short distance. The distance between the entrance and the outlet is less than half a mile. The river then flows east for eight miles to O'Sullivan lake. In this distance the river is wide and deep, and there are three bad rapids which cannot be run with loaded canoes.

The main part of **Abamisagi lake** is eight miles long and two and a half broad, with regular shores and few islands. There is a narrow bay to the northeast, which I was told extends three or four miles in that direction.

O'Sullivan lake is very irregular in shape; for nine miles it lies northeast, following the course of the river. In this distance it is about a mile wide, but narrows considerably in one or two places. The larger body of the lake lies southeast from the inlet, extending in that direction five miles. This part is cut up by long peninsulas and islands, some of which are large, especially in the east. The Indian name "Sesekenaga" signifies that the lake has many islands clustered together in groups. Its shores are mostly low, but in places, especially on the northeast, the rocks rise abruptly from the water to a height of 40 feet. On the southwest the land slopes gently back from the lake to a height of 200 feet, and at a distance of about four miles there is a prominent hill which rises much higher. This hill is a conspicuous object both from Eskegenaga and Abamisagi lakes. The forest round this lake is mostly second growth.

Between O'Sullivan and Percy lakes there is a succession of lake expansions, some four miles long, connected by stretches of rapid water and falls which necessitate eight short portages. Percy lake is eight miles long and a mile and a half broad. The longer axis has an east and west direction, the Little Current entering a mile from the west end. At the extreme west end this lake receives another rapid river, which appears to be about the same size as the Little Current. From information gathered from the Indians it is inferred that this is probably the Kapikotongwa river, which forms part of the canoe route from Lake Nipigon to the Albany river. A well travelled route from near the north end of O'Sullivan lake connects, through a chain of lakes, with the Kapikotongwa river some distance west of Percy lake.

For sixteen miles below Percy lake the river is broad and deep, with sluggish current. At this distance there is a beautiful fall, 24 feet high, divided into two drops of equal height. It is also divided in the middle by an island. Below this to the contact of the Palaeozoic and Archaean rocks the river is narrower and rapids are common. In this distance there are ten portages. In some places the river runs in narrow gorges through gneiss which forms steep walls 30 to 40 feet high, the river itself being less than a chain wide. There are many excellent water powers along this stretch. A short distance below the above contact a large stream enters from the south, and is probably the river that drains Eskegenaga lake. The Indians say it forms a canoe route to Long Lake House and they describe it as very rapid with many portages. Near the mouth it is 230 feet wide and 4 feet deep, with slow current. Where this branch enters, the main river is over six chains (435 feet) wide. From this point to the mouth there are no portages, though there are occasional rapids or stretches of swift water where the river is wide and shallow.

Speckled Trout, 16" to 20" long, from upper Drowning river, Kowkash country

Route from Kawashkagama River to Drowning River.—Two miles below Kawashkagama lake a portage of 67 chains over sandy Banksian pine ridges and spruce swamps leads to Wawong lake. This lake is two and a half miles long. The shore line is very irregular, numerous sand and gravel ridges extending into the lake, forming deep bays. In two places a portage of only 10 to 20 feet across a low neck of sand was required to pass from one bay to the other. The lake is surrounded by a rolling sandy country, covered for the most part by Banksian pine and poplar. The water, as the Indian name implies, is very clear, and of a peculiar bluish-green color. From Wawong lake the canoe route runs northeast through four small ponds and five short portages to Eskegenaga lake, a distance of a little over two miles. Most of the country along this route is similar to that round Wawong lake, with some areas of good soil well wooded. There are no rock exposures.

Eskegenaga (raw bones) lake is over twelve miles long, and averages about three miles in breadth. There are seven deep bays, and the whole shore line is irregular. The lake is full of islands, some of consider-

able size, especially in the eastern part. Two or three small streams enter the lake. The outlet, which flows into the Little Current river, is from the northeast arm, and at a distance of about a mile from the lake becomes rapid and shallow. Several soundings were taken in the lake, showing a maximum depth of 56 feet. Depths of between 40 and 50 feet were common near the middle. The surrounding land is generally low, but on the south an occasional hill rises 200 to 300 feet above the level of the water. Except in a few limited areas the forest growth is all small, being about thirty years old.

The portage eastward from Eskegenaga lake is from the east bay, and is half a mile long. It is chiefly through a sphagnum swamp almost muskeg in places. Groves of tall slender spruce 8 inches in diameter occur near the lake. This spruce would make good pulpwood. Tamarack and cedar also grow on this portage. A small lake and short portage come next, then follows Collins lake, which is over five miles long and less than a mile broad. It contains numerous islands and drains east, but the stream out of this lake is not followed; instead two portages and a small lake to the north are used. On these portages and lakes there are some large spruce and poplar. The next lake is one of considerable size, and the Indians say the stream flowing from it forms an excellent canoe route to the Little Current river. The lake extends eastward for a long distance and is shallow in places. The portage out of it is a mile and a quarter in length and is through a spruce swamp which at the east end is rather open muskeg. The next lake is small, and the portage from it leads into Wababimiga lake. This portage is over a steep hill, and has some excellent forest on it.

The route eastward from Wababimiga lake follows a deep bay to the south, and then a small brook running into it for a mile and a half, when a series of five portages and four lakes lead to Drowning river, a distance of seven miles. The five portages aggregate over three miles, and the lakes are all very small except the most easterly, which is two miles long. The first portage on the west is over burnt ground with scattered Banksian pine thirty years old. The other portages are mostly through sphagnum swamps, with dense forests of black spruce and tamarack.

Description of Rock Exposures.

The Little Current and Kawashkagama Rivers.—A reddish granite-gneiss and mica diorite-gneiss striking N. 40° E. appear in occasional outcrops for five miles below the Wawong lake portage. At the rapid just above Rupert fall there is a pyritous, hornblende schist, dipping 20° S. 40° E. The contact between the gneiss and schist was not seen, as the country is drift covered, and about six miles separate the two nearest exposures along the river. Between Rupert and Howard falls there are numerous exposures of hornblende and chloritic hornblende schist, the color varying from dark to light green. At the point where the river turns to the northwest there are outcrops which contain numerous stringers and veins of quartz, some of which are 12 in. wide. There are also irregular masses of quartz mixed through the rock. At Howard fall the schist strikes east and west, and is either vertical or dips south at a high angle. All these schists contain much disseminated pyrite. At the fall there are numerous quartz veins and lenticular masses, in one of which ilmenite in small quantity is found. One mile farther down, a rock similar to that at Howard fall outcrops, dipping 80° S., and also at the next short portage where it is vertical, and strikes N. 80° E. Numerous granite boulders occur in the river below this portage. In going west from the inlet along the south shore of Abamisagi lake the first rock seen is a coarse grained biotite-hornblende granite. Farther west a fine grained biotite-muscovite granite is seen. This rock is frequently cut by wide dikes of coarse pegmatite. Exposures of granite of varying texture occur along the south shore to the west end of the lake, where they form low rounded hills. Rocky cliffs were seen at the mouth of the northeast bay, but were not examined closely. On the first portage below the lake there is a knob of gneissoid granite. At the second portage the rock is finely laminated, and is a biotite schist dipping 50° N. 35° W. It contains masses of rusty quartz. At a small rapid above the last portage before reaching O'Sullivan lake there is a fine grained schist dipping 70° N. 60° W. This rock breaks off into broad thin slabs. At the last portage there is an actinolite schist. The hand specimen has a grey, slightly green color, and appears to be composed of numer-

An outcrop on O'Sullivan Lake

ous dark green grains and prism-like individuals of actinolite separated by a lighter colored material. Under the microscope the rock is seen to be composed almost altogether of actinolite in broad plates and fibrous aggregates.

O'Sullivan Lake.—Fine grained, biotite schists occupy the northeast shore of the lake, except a small area just below the narrows, where there is an exposure of coarse grey granite. The schists strike from N. 60° E. to N. 80° E., and are usually vertical, and may belong to the Huronian group.

In following the southeast shore, in the first deep bay east of the inlet there is a massive diorite, which, in places, shows a gradation from fine grained to coarsely crystalline. In the eastern part of the lake, a grey-quartz diorite and an epidote granite are mixed with the schists. On a small island three miles southeast from the inlet, there is a band of sericite schist eight feet wide, striking N. 78° E. and vertical. Lying on the west side of this band there are about 12 inches of ochreous powder containing masses of bluish quartz mixed with the sericite schist. The surrounding rock on the island is finely schistose, and of a dark grey color. All three of the hand specimens brought from these bands effervesce somewhat freely when touched with dilute hydrochloric acid. A similar band of sericite schist occurs on another island about a mile and a half farther north. Several exposures of diabase and fine grained greenstone occur on the neartheast shore and adjacent islands. About three miles from the foot of the lake on the west side

Sketch map of Kowkash district. From W. J. Wilson's report. Keewatin rocks along canoe routes are marked xx. Dodd's discovery is near Howard fall in centre of map.

there is an outcrop of coarse muscovite gneiss containing small garnets. North of this to the end of the lake, and for some distance down the river, there are exposures of hornblende and biotite schists, followed by granite and gneiss.

For some distance below O'Sullivan lake the hornblende schist, biotite gneiss and granite are intermixed, but as the river is descended, and before Percy lake is reached, a rusty weathering, garnetiferous gneiss, interfoliated with diorite gneiss, and in places with finely banded syenite gneiss and biotite schist, is the prevailing rock, and is seen in frequent exposures. The biotite schist sometimes forms a considerable portion of the rock. These rocks are generally well foliated; they strike nearly east and west, and dip northward at an angle of from 30° to 50°. In going down the river the last large exposure of these rocks is seen at the eighty-ninth mile from the mouth, where a grey granite gneiss outcrops, dipping 65° N. 15° W. This is succeeded by four miles of fossiliferous dolomites, then a small mass of hornblende granite about ten chains wide crosses the river. Below this for a long distance cream colored fossiliferous dolomites are the only rocks seen; and these are followed by soft, argillaceous grey and brick-colored dolomites.

Mr. E. V. Neeland's Report.

In 1900 Exploration Party No. 5, in charge of W. S. Davidson, O.L.S., sent out by the Department of Crown Lands, explored a portion of the country tributary to the Kenogami river. Mr. E. V. Neelands, geologist of the party, reports on the country northwest of Long lake, including Kowkash, as follows:—

"Fleming's lake is about six miles long and two miles wide, but very irregular in shape. The banks are usually high, with sand beaches and sometimes bluffs of gneiss striking about west. The country in the vicinity of the lake is well timbered with large spruce and jack pine.

"For about two miles the upper continuation of the Kawakeshkagama river passes through level country, clay along the banks but sandy farther back, to Duck lake, which is an open body of water lying at right angles to the general course of the stream. A few bluffs of gneiss are seen along the shores. Above the lake is two miles of river to Egg lake. No rock occurs in the stretch, except the gneiss so characteristic of the district. Egg lake is about two and a half miles in length, and two rivers enter at the southwest end. On a point between these occurs a coarse-grained mica schist and some decomposed gneiss. A short distance from the mouth of the western stream is an outcrop of fine-grained diabase and about a mile and a half above this is Bell's lake. This lake is about a mile and a half long, with sandy shores, but no rocks are seen. Above this the river was followed for about five and a half miles till canoe navigation was finally interrupted by thick alder bushes in which the river loses itself. From a tree top the country was seen to be burned for a long way in every direction.

"Ascending the southern river, about ten chains brings us to a small marshy lake, above which, with the exception of one small rapid, the river is deep and sluggish for five miles to Mountain lake. Near the outlet of the lake the shores are rocky, and inland the country is very hilly. The only rock is a fine-grained granite. The total length is about five miles. From a bay southwest of the outlet is a portage leading to a large lake, which, according to Mr. Godchere, the officer in charge of Long Lake House, flows westward to Lake Nepigon.

"Below Fleming's lake the river is rapid for about fifteen chains, and then flows quietly for about three miles to Kawakeshkagama lake. The river is deep with marshy shores generally, but in one place occurs an exposure of mica schist and gneiss striking north 65 degrees east, and dipping north 80 degrees. On Kawakeshkagama lake the course is down the left shore for about two miles. Gneiss is found on the east shore and on several islands, striking about north 55 degrees west.

"Two miles below the lake a portage leads to Wawong lake, a beautiful and very irregular sheet of water, with sand beaches but no rock exposures. From its extreme north end a portage runs to a small lake from which a short canoe route leads to Oskanaga or Bare Bones lake, which is said to be twenty-five miles long and flows north to the Albany river.

"Below the Wawong Portage the river was followed for about twenty-five miles. The country is burned, with large sandy hills covered with small jack pine, and some extensive exposures of red gneiss for about five miles. Several small rapids occur in this stretch, which terminate at Rupert's Falls. A short distance above this occurs an outcrop of Huronian chlorite schist, and similar rocks are seen as far as the river was explored. The strike of this series of rocks was about northwest, and the dip north 60 degrees. Below the falls the river is swift, with high clay banks, well timbered with large spruce, poplar, tamarac, birch, balm of Gilead, up to thirty inches in diameter. Numerous exposures of chlorite schist occur everywhere in this stretch. Some samples from small quartz veins in one extensive exposure striking north 15 degrees west, gave a trace of gold on assay.

"There are two more rapids in this part of the river where portages are necessary. The first, Driftwood Portage, is eight chains long, the trail being on the right bank, and the second, Howard Rapids, with the trail on the left bank. Here the river narrows to about ten feet and plunges through a miniature canyon for fifteen chains, forming a beautiful and picturesque series of chutes and waterfalls.

"Owing to the limited time at the disposal of the party no attempt was made to descend the river farther; but it is said by the Indians to afford a good canoe route from the Albany river, owing to its freedom from rapids.

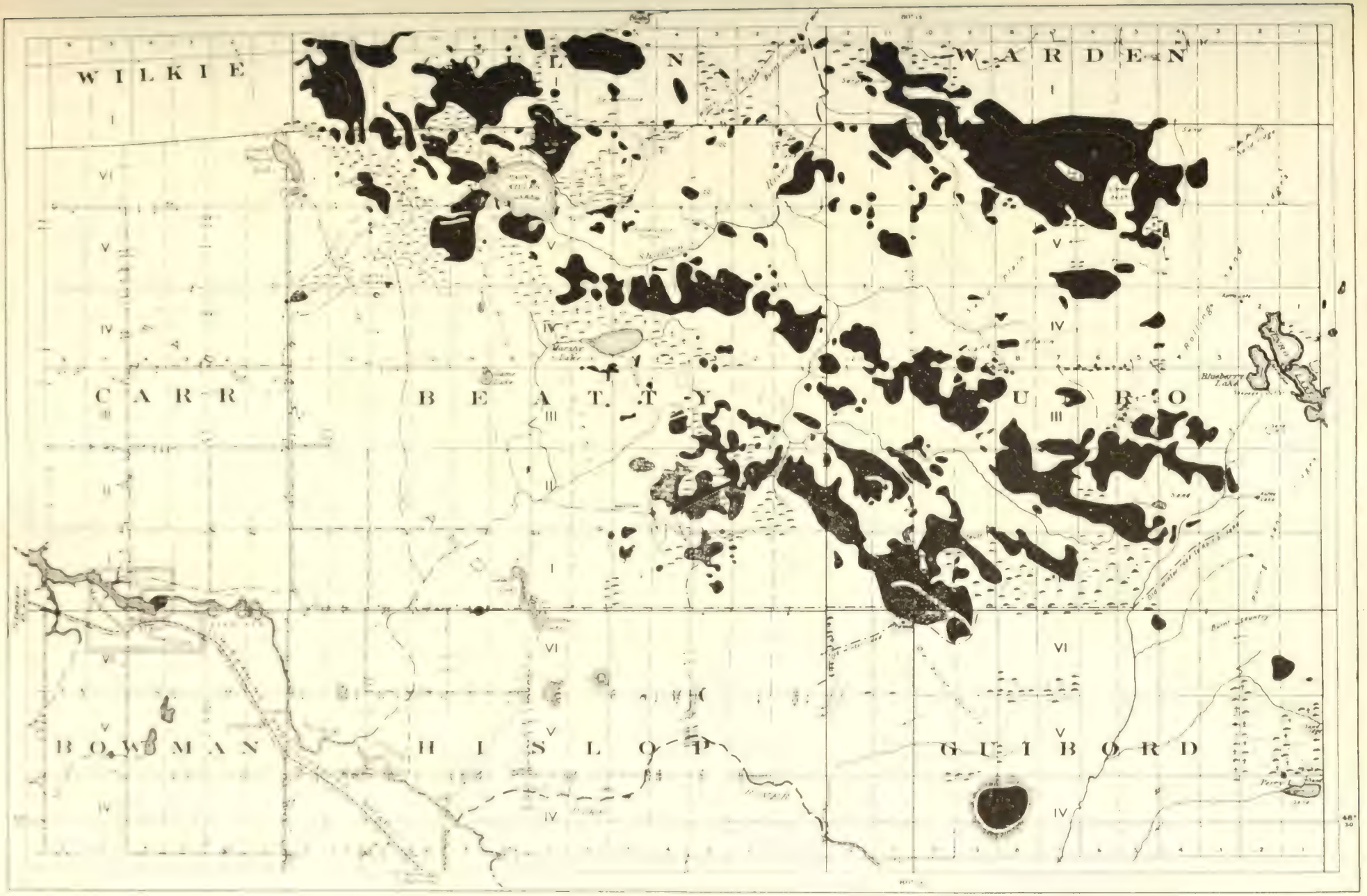
"At several points along the northeast bank of the river portages lead to Lake Oskanaga, and on the southwest is a canoe route via a tributary stream to Lake Nepigon."

THEORY AND PRACTICE OF ORE DRESSING—BOOK REVIEW.

By Edward S. Wiard, S.B.—McGraw-Hill Book Co.—Price $4.00—For sale by Book Department Canadian Mining Journal.

In a book of 420 pages Mr. Wiard treats of all phases of ore dressing as applied in western American mining districts. Stamp milling is not dwelt upon at length and amalgamation is not mentioned. The chapter headings are: Preliminary considerations relating to installation of ore dressing plants; Testing of concentrating ores; Location of mills; Crushing plant; Separating plant; General dissertation on crushing; Rolls and medium crushers; Means for raising ore; Grading; Separation; Sand and slime concentration; Miscellaneous processes.

The book has been written chiefly for mine managers and engineers in charge of mining enterprises. The information contained should be useful also to those in immediate charge of concentrating machines.



Map of Munro and neighboring townships, showing rock outcrops and road from Matheson. Dobie-Leyson claim is in N.E. corner of Lot 10, Con. 1, Munro township. *From report of P. Hopkins, Ontario Bureau of Mines.*

HONOR ROLL

It is our intention to publish from time to time lists of employees of mining companies who have enlisted for service. The following is by no means a complete list. Our readers will confer a favor by sending us information concerning mining men who have enlisted.

Algoma Steel Corporation—

Mr. W. K. Whigham, vice-president of the Steel Corporation, is now Captain in a Territorial regiment and is somewhere in France.

Capt. D. C. Newton, was a director of the Steel Corporation, and was with the Princess Patricia Regiment. He was one of the first Canadian officers to be killed.

Mr. J. E. McLurg, a Lieutenant in the Second Battalion of the First Canadian Contingent, was wounded and taken prisoner at battle of Langemarck.

Mr. Donald McMillan, employed at the Magpie mine, was with the First Canadian Contingent and was one of the first to be killed.

Mr. R. R. Rose left to join one of the regiments in England, the Gordon Highlanders, and is now believed to be in France.

Many other employees of the Steel Corporation have enlisted, the majority of them were employed at the steel plant, and it would be very difficult to get a full and complete list of their names. At least one hundred men are now on active service.

Asbestos Corporation of Canada, Ltd.—

D. Douville, Canadian Ordnance Corps, C.O.C.E. E.F., Ashford, Kent, England; Joseph Martineau, private 41st Regiment, A Company, Squad 5, Valcartier; Emil Lessard, private 8th R.R.R., Camp Lauzon, Levis; C. H. Hayes, private, 6th Royal Army Medical Corps, Shorncliffe Camp, England.

The British Columbia Copper Co., Ltd.—

R. G. Hargreaves, now First Lieutenant with the Second Ammunition Corps, stationed at Dibgate Camp, Shorncliffe, Kent, and O. R. Matthews, Sergeant-Major in the 54th Battalion, now stationed at Vernon, B.C.

In addition to these men, a number of minor employees have enlisted. Their names are not at present available.

Canadian Copper Co.—

Herbert V. Knowles, tapper; Thomas Burn, brakeman; Sidney Simmons, brakeman; F. A. Lake, trammer; J. Wood, blacksmith; Bert Millen, steam shovel foreman; Sidney Rhodes, watchman; Milton Hanlon, tapper; Wyman Hanlon, brakeman; Ernest Hanlon, scale clerk; James Phillips, trammer; C. H. Lewis, timekeeper; C. Austin Bell, mines maintenance engineer; G. E. Chittleburg, fitter; James Ault, laborer; Wm. Campbell, hoistman; Wm. Russell, trammer; Sidney Smith, fitter.

Canadian Mining and Finance Co.—

H. Garner, G. H. F. Adams, C. E. Barnett, G. D. Kelly, T. Cotton, L. G. Smith, Bafreau LeFevre, J. M. Bowery, A. H. McKay, J. Head, V. M. Valenza, D. James, J. Adamson, H. Tippett, J. Haldane.

Canadian Sulphur Ore Co., Ltd.—

Newell Broad and Charles Wilds in the First Contingent; Fred Lapalm, Nelson Lapalm and Martin Lapalm in the Second contingent.

Canmore Coal Co., Ltd.—

A. J. Briggs, Sr., 12th M.R., Calgary; Harold Musgrove, 12th M.R., Calgary; Wm. Rappel, 13th M.R., Calgary; Thos. Rappel, 13th M.R., Calgary; Wm. Monkton, 13th M.R., Calgary; Gideon Broderick, R.A.M.C., Calgary; F. J. Pierce, R.A.M.C., Calgary; A. J. Briggs, Jr., R.A.M.C., Calgary; Matt Briggs, 50th Batt., Calgary; Robt. Nicholson, 50th Batt., Calgary; Jos. Grainger, 50th Batt., Calgary; Alfred Hatfield, 50th Batt., Calgary; J. H. Campbell, 50th Batt., Calgary; Robt. Towers, 50th Batt., Calgary; H. A. Maxey, 56th Batt., Calgary; Dan Thomas, 20th Battery, R.F.A.; H. S. Baker, 5th Co., Field Engineers.

Coniagas Mines, Ltd., and Coniagas Reduction Co., Ltd.—

Chas. Briscoe, private, Army Vet. Corps, C. E. F.; John Briscoe, lieutenant, 76th Batt., C.E.F.; Arthur L. Bishop, lieutenant, 2nd Middlesex Regiment (wounded at Fromelles, mentioned in despatches May 31st, 1915); James Bishop, Sergeant Cook, 37th Batt., C.E.F.; Leonard Bishop, 2nd lieutenant, 4th Mounted Rifles, C.E.F.; Ernest Bowler, corporal, Princess Patricias, C.E.F.; Harry Branigan, gunner, 10th Field Battery, C. E. F. H. E. Cowley, gunner, 10th Field Battery, C. E. F.; (promoted—Lieut. 9th Battery); Arthur E. Clough, sergeant-major, 12th Royal Welsh Fusiliers; F. Coullecutt, joined force in England; De La Courneuve, Q. M. sergeant, 37th Batt., C.E.F.; Fred Drunnel, private, Grenadier Guards; E. N. T. Griffith, pioneer sergeant, 37th Batt., C.E.F.; Wm. Nicholson, gunner, 10th Field Battery, C.E.F.; R. P. Rogers, captain and adjutant, 37th Batt., C.E.F.; John Rose, captain, Northumberland Fusiliers; Leonard Singleton, gunner, Borden's Armored Battery; John Sumbler, private, 37th Batt., C.E.F.; J. Truscott, joined force in England; Amos Welham, gunner, 10th Field Battery, C.E.F.; R. F. Baker, driver, 10th Field Battery, C.E.F. (awarded D.C.M. and Lieut. 11th Battery); Geo. Begy, captain, 4th Batt., C.E.F. (wounded at Ypres); John Doyle, gunner, 10th Field Battery, C.E.F.; Robt. Haylock, enlisted in England; W. B. King, major, 10th Field Battery, C.E.F. (awarded D.S.O.); John Mackney, gunner, 10th Field Battery, C.E.F. (died at Salisbury); Richard W. Raynor, gunner, 10th Field Battery, C.E.F.; Arthur Turnbull, Q. M. sergeant, 14th Field Battery, C.E.F.; Guiseppe Bettio, 88th Regiment, Fonteria; Vittorio Casagrande, 57th Regiment, Fonteria; Angelo Zappi, 8th Regiment, Fortress Artillery; J. Brown, Royal Navy; J. Bastable, 44th Regiment; Wm. Barkley, 10th Field Battery; R. Bocock, 44th Regiment; J. Briggs, H.M.C.S. Niobe; W. Catterall, sergeant, 44th Regiment; J. Ellis, 19th Regiment; E. Farnworth, 19th Regiment; A. Gray, 19th Regiment; W. E. Holland, captain, 36th Regiment; W. Hunt, 19th Regiment; W. Morris, 44th Regiment; J. Morris, 44th Regiment; E. Riding, 44th Regiment; W. Ryder, 44th Regiment; Adamo Lorenzetto, 5th Bersaglieri; Domenico De Marchi, 68th Reggimento, Fanteria; Luigi De Marchi, 55th Reggimento, Fanteria; Angelo Modesto, 68th Reggimento, Fanteria; Isidor Bandera, 68th Reggimento, Fanteria; Girolamo De Marchi, 55th Reggimento, Fanteria; Ettore Zago, Artiglieria di Campagna; Tiso Zago, 68th Reggimento, Fanteria; Gesue Cararo, R. R. Carabiniere; Carlo Bartelli, R. R. Carabiniere, Sante Bosco, 55th Reggimento Fanteria; Ruggero Visentin, Artigliera di Montagna; Constante Visentin, R. R. Carabiniere; Amedo Visentin, Cavalleria; Pietro Ferlan, 55th Reggimento, Fanteria; Giovanni Vanin, Sussistenza; Arcangelo Vanin, Cavalleria (Lancieri); Ettore Bellio, 5th Bersagliere; Mose Bellio, 55th Reggimento, Fanteria; D. Ambrosi, Pio, Cavalleria (Lancieri); Francesco Severin, R.R. Carabiniere; Antonio Boscoe, Cavalleria; Antonio Favero, 55th Reggimento, Fanteria.

The Consolidated Mining and Smelting Co. of Canada, Ltd.—

Lieut. A. J. L. Evans, 3rd Batt. (mentioned in despatches for distinguished services); Lieut. Angus Ward Davis, 177th Co., Royal Engineers; Lieut. R. G. Macfarlane, 171st Co., Royal Engineers; Capt. K. B. Carruthers, 26th Battery, 7th Brigade; Corp. A. B. Ritchie, 1st Brigade Artillery (Distinguished Service Medal); Pte. Robt. Walker, 34th Div., Signal Co., Royal Engineers; Graham Cruickshank, Vancouver, Officers Training Corps; Frank A. Fortier, Instructing Recruits; Lance-Corp. H. St. C. Marlatt, 3rd Field Co., Can. Engineers.

The above were members of the company's staff. The list of other employees is not yet available.

The Dome Mines Co., Ltd.—

F. C. Andrews, J. Meiklejohn, Chas. Berger, James Hogg, J. Taylor, W. A. Montgomery, John Brennen, R. E. Binns, J. J. Rutherford, Alex. Kinnard, A. McEachern, B. Curtis, F. Groves, Geo. Scott.

Dominion Coal Co., Ltd.—

Regarding the furnishing of names of employees who have enlisted, Mr. F. W. Gray says: "I fear this will be impossible so far as the Dominion Coal Co. is concerned, as over 1,000 of our men have gone, practically all of them as private soldiers."

Huronian Belt Co., Ltd.—

The first man to leave this company's employ for the front was Mr. Beresford Lees, a graduate of the Cambourne School of Mines and of the University of Manchester. Mr. Lees was an assistant on the staff of the Huronian Belt Co. last summer, but left for England in October, where he obtained a commission in the 3rd Northamptonshires. Unfortunately he was killed at Neuve Chapelle.

Mr. Reginald Montague, secretary, went to England in November and has now a commission in the Public School Battalion of the Royal Fusiliers.

Mr. J. W. Cashman, who was clerk of the North Thompson mine, is with the 20th Batt. of the 2nd Canadian Expeditionary Force.

Mr. Peter Clarke, assistant manager of the Huronian Belt Co., has a commission in the Wiltshires, while Mr. G. G. Gibbins has a commission in the Royal Engineers.

Dr. J. Mackintosh Bell has a commission in the 5th Royal Highlanders of Montreal and is going to the front with the 73rd Batt., that is the 3rd Expeditionary Battalion which the Highlanders have sent to the front.

Jasper Park Collieries, Ltd.—

S. McDermid, M. J. Cranston, W. Inman, D. Davies, F. E. O'Neal, D. Montgomery, C. F. Harvey, D. Strang, J. Turnbull, T. Dawson, H. R. Simpson, J. Barclay, E. Davis, D. Gauvin, S. Deigle, C. McPherson, A. Shaw, E. Jaumbe, D. Harris, J. Davis and R. H. Sheffield.

Leitch Collieries, Ltd.

Harry Parsons, Ernest Houghton, Harold Houghton, Nat. Evans, Louis Zeiderman, Geo. Redman, Thos. Knowles, James Shenfield, Sam Grontage.

McIntyre-Porcupine Mines, Ltd.

Lieut. Ernest N. Holland, Borden's Armored Battery; Q. M. Sergt. H. Holland, Borden's Armored Battery; Pte. Digby Salkeld, Borden's Armored Battery; Pte. B. A. Brady, Borden's Armored Battery; Pte. Jas. E. Sullivan, Borden's Armored Battery; Pte. William Ramsey, R.A.M.C.; Pte. John Ramsey, R.A.M.C.

The Mond Nickel Co., Ltd.—

The following young engineers from the staff have entered the service: C. H. Webb, M. Baker, D. L. McLeod, W. Goodwin, E. J. Pilcher, V. C. Elderkin. V. C. Elderkin was killed in action.

From among the Mond Nickel Co.'s other employees the following have enlisted: Osman Griffiths, John Fletcher, Maik Yankowich, Peter Zlatar, Chas. Murphy, John Smith, H. Rigby, W. Clement, H. Stevens, W. Crossby, M. Ugorm, R. White, W. Tuddenham, R. G. Spurles and John L. May.

Moose Mountain, Ltd.—

Sergeant R. C. MacKenzie, No. 25966, Royal Montreal Regiment, 14th Canadian Battalion, British Expeditionary Force, France.

O'Brien Mine—

Pte. Duncan McLeod, machinist, enlisted with the First Contingent, 48th Highlanders. Was in hospital from gas after battle of St. Julien. Is again on active service; Pte. Sullivan, miner, enlisted with McLeod; Pte. George Edwards, miner, British reservist, was one of the first to respond to the call, has been wounded and in hospital, but is again on active service; Pte. Chas. Garde, cook's helper, enlisted with the Second Contingent, but was drafted amongst reinforcements for First Contingent, 48th Highlanders.

Nipissing Mining Co., Ltd.—

Farr.-Sergt. John Mackney, 10th Battery, C.F.A. (died at Salisbury, cerebro disease); Sergeant Percy Dunbar, 15th Batt., 1st Cont. (prisoner of war); Pte. Lyman Ramey, 15th Batt., 1st Cont. (prisoner of war, wounded); Pte. Robt. Hendry, 15th Batt., 1st Cont.; *Pte. Wm. Strickland, 15th Batt., 1st Cont.; *Pte. Ellard Bigelow, 15th Batt., 1st Cont.; Pte. George Hendry, 20th Batt., 2nd Contingent; Lieutenant Fred McPhun, 35th Batt., 3rd Cont.; Bugler Geo. Ritchie, 37th Batt., 3rd Cont.; Archie Hamilton, enlisted in his home regiment in Scotland.

*Messrs. Strickland and Bigelow formerly worked for this company, and it is altogether likely they will be found on some other list.

Penn-Canadian Mines, Ltd.

Morley Cox and Richard Marshall left with the 3rd Contingent, 97th Algonquin Rifles, for Niagara. On June 9th they were included in a squad of 50 men who were sent across to England, and latest word from them is that they are now in the 17th Canadian Reserve Battalion, No. 2 Co.

Peterson Lake Silver Cobalt Mining Co., Ltd.

G. F. Morrison left his position as secretary of this company to enlist for active service.

Temiskaming Mining Co., Ltd.—

Ben Bick.

The development of copper mining properties on Vancouver Island [illegible] now than at any previous time since the closing of Tyee mine at Mt. Sicker several years ago. Copper ore of good grade is being mined at Sooke, southwest of Victoria, and is being shipped to the smeltery at Tacoma, Puget Sound, Washington. One shipment of 200 tons is reported to have yielded copper at the rate of 10 per cent., with small value in the precious metals as well. Work [illegible] on the group of mineral claims in the northern part of the island bonded by Mr. Maurice W. Bacon, general manager of the Stewart Mining Co., operating in the Coeur d'Alene district, Idaho, and associates. A recent announcement was to the effect that Mr. Fred. J. Rollands, of Spokane, Washington, was arranging to do some exploratory work on the Lenora property. Quotations on [illegible] mining [illegible] for a number of years. Several others into prominence are also being prospected.

RULES AND REGULATIONS FOR METAL MINES.

A publication of considerable interest to the metal mining districts of the United States has just been issued by the Bureau of Mines, under the title, "Rules and Regulations for Metal Mines." It is to be known as Bulletin 75, and the authors are W. R. Ingalls, J. Parke Channing, James Douglas, James R. Finlay, and John Hays Hammond. The committee was originally appointed at a meeting of the American Mining Congress at Denver, Colorado, in November, 1906, and its object was the drafting of a modern law governing quarrying and metalliferous mining which could be recommended to the several States for adoption, in the hope that the passage of such a uniform law by the mining States would tend to lower the number of fatal and serious accidents.

When the committee took up its work, it found that Colorado, Missouri, Montana, and New York were the only states that had enacted mining laws of broad scope applicable to other than coal mines. California, Arizona, Idaho, Kansas, Michigan, Minnesota, Nevada, New Mexico, North Carolina, Oregon, South Dakota, Tennessee, Utah, Washington, and Wyoming, were found to have statutes pertaining to metalliferous mining, but with few and incomplete safety provisions.

This committee of the American Mining Congress did considerable work along this line and made a number of reports. In April, 1911, Dr. Joseph A. Holmes, Director of the Bureau of Mines, invited the committee to serve as a committee of that bureau with the idea of preparing a final draft of a law, and this was accepted.

Starting with a composite of existing laws, the committee by successive stages endeavored to work out a general law that would embody the best mining thought of the day, be in accord with approved modern mining practices, and yet at the same time be effective and practical in operation, and not merely a collection of rules and regulations to be disregarded or enforced at will.

The committee in discussing its report says: "We have found that a great deal of interest and attention among mine operators has been awakened by our advocacy of improved means for promoting safety in mining. However, we are under no illusion that our recommendations will be immediately and generally adopted. We consider our work to be especially of educational character rather than anything else. It will be useful in three main ways, we think, as follows:

1. As a basis for State legislation;
2. As a basis for private systems of inspection;
3. As a collection of simple rules for the guidance of everybody engaged in mining.

Since the publication of our first report several States have adopted new mining laws and amended their old ones. In this connection our code has served some purpose; for example, in the drafting of the laws that now stand on the books of the States of Nevada and Arizona. We do not expect that any State will at once adopt all of our recommendations, especially those that are essentially of legal character. We offer them as what we think ought to be and hope some day will be.

Since our first publication, furthermore, most of the mining companies of consequence have adopted inspection systems or have at least framed codes of safety rules, which have been based to a large extent on our code, notably so in the case of the Cleveland-Cliffs Iron Company. This tendency, in fact, has become one of the most important phases in the national movement for "Safety First." This is the gratifying consummation that we had in mind. Unquestionably, also, the widespread adoption of State laws providing compensation for injured workmen has helped the safety movement by making accident prevention worth while.

We consider, however, that the chief usefulness of the code of rules that we have formulated will be to small operators, who frequently engage in unsafe practices without knowing that they are unsafe or without thinking about the matter at all. There is a reasonable hope that our report will be of educational value to all mining operators.

The act that we have drafted may be regarded from two angles—from the legal and from the technical. With respect to the latter we have had in mind the conditions and practice of mining existing and prevailing in the several parts of the United States. In our treatment of the matter from the legal standpoint, in which we have had the advice of good lawyers, we have refused to clothe the inspector of mines with the optional powers that are given to him under the laws of many of the British colonies, and, also, we have refused to convey to him the sweeping power that is given to health inspectors in some of our own States.

The code of mining rules that has been finally drafted by the committee is the co-ordination of the experiences, opinions, and suggestions of a great many men who have assisted the committee in an advisory capacity and as directly employed aids. The former have included many engineers actively engaged in practice, members of professional societies, and members of the bar; the latter have included members of the regular staff of the Bureau of Mines and of the personal staffs of members of the committee. The committee has sought to obtain many points of view and to summarize many experiences. The draft that has been prepared is not offered as the last word upon this subject. There are many phases of this subject with which the committee has been unable to deal thoroughly. Thus the committee confesses its inability to formulate at the present time adequate rules covering the important subject of ventilation of mines. Similarly there are many practices in open-cut mining, by steam shovels, etc., regarding which the committee has felt unable to formulate rules. We feel, however, that the rules so far as prescribed may advantageously be applied to open mining whether it be simple quarrying or the extraction of metalliferous mineral, as well as to underground mining.

ANTIMONY.

One of the picturesque features of the war has been the unusual mining profits which it has created. Among the beneficiaries have been the Chinese and Japanese owners of the world's largest antimony mines, which are located in those two countries. We hear of one Chinese mine owner who has been making profits of 700 per cent., due to the remarkable rise in antimony prices.

Before the war started, antimony had been sluggish for two years, the price hanging around 5 to 6 cents per lb. The present quotation is 40 cents per lb. So sensational has been the rise that one of the largest commercial users of antimony in the United States has recently sold a considerable tonnage at a very handsome profit.

What has put the price of antimony up has been the same influence that has stimulated spelter's advance. Antimony is used in the shot or bullets in shrapnel. Some 10 to 12 per cent. of the weight of these bullets is antimony. England at one time put an embargo on every ton of antimony in the tight little island kingdom, but relaxed it later.

EPOCHS IN SCIENCE*

By Lucien Ira Blake.

It is a commonplace to say, this is the age of Science; this is the age of invention. Our minds are lifted up at thought of the telephone, the wireless, the automobile, the aerial and submarine craft. We exult that we live in an Age of Wonders, and we hold our breath at thought of the future. We even cry out to each other—What next in Science? and some are emboldened to even hazard a prediction. Every invention is heralded as destined to revolutionize something. We assume it as surely self-evident that the past records of Science can never claim such progress as the present. All this exultation and confidence is perhaps well grounded, but it reveals nothing as to Science itself.

Might it not be well to pause a bit and ask why has this become an age of Science and invention; whence and how has it come? What has made it such? Has there been a sudden or a gradual evolution toward it? Can we find the forces which have made for its growth? Can we lay down the conditions for its future advancement? Can we pick the winners of its future successes?

It is passing strange, but our age of Science and invention has not been reached by any gradual growth. It has hitched along, sometimes set back for years; sometimes, with a sudden leap, enormously advanced. It has come to us in epochs; each epoch built up around a discovery; each discovery originating in some master mind. So the growth of every branch of Science might be traced by plotting a succession of its epochs. It would show a curve of master minds.

Let us think of mathematics. Napier in England invented logarithms. Descartes in France, analytical geometry; Leibnitz, in Germany, differential calculus. These three great discoveries, which put three sharpest tools into the kit of the mathematician, came approximately a generation apart, and came from three different nations highest in the learning of that century—England, France and Germany.

Leibnitz was a self-taught mathematician, though at eight he could read Latin and at fifteen had entered the university. Descartes and Napier were both of parentage high in rank and intellect. They all were master minds and the science of mathematics leaped forward in three brilliant epochs. There were hundreds of lesser mathematicians, who worked over details, but their inspiration came from the masters, and their results rounded out the epochs.

It is remarkable, but concurrent with Leibnitz' invention in Germany, there appeared in England "The Book of Fluxions," by Sir Isaac Newton, which proved to be an independent invention of the calculus. Thus two master minds of different nationalities and in wide separated countries evolved the same discovery and almost simultaneously, and this is not an infrequent occurrence in the history of science.

The sensitive temper of the times toward science was well stirred by this advent of "The Book of Fluxions," which seemed to intrude upon the field of the divine. Bishop Berkeley expressed it in "A discourse addressed to an infidel mathematician." He wrote: "It is presumptuous to assert that the opinions of mathematicians in matters of faith are likely to be more trustworthy than those of divines. . . . In the much vaunted fluxional calculus there are mysteries which are accepted unquestionably by the mathematicians, but which are incapable of logical demonstrations."

The rebuff and suspicion of the day seems only to have extended the new knowledge which the epoch had brought to mathematicians.

Let us turn to astronomy. Galileo was practically the inventor of the telescope. Doubtless he had heard of Lippershay, the spectacle maker in Holland, who had put lenses together which brought remote objects near, but Galileo constructed instruments of magnification such that by them he discovered for the first time that Jupiter had satellites; that Venus had phases; that mountains, craters, lava, scarred the pale face of the moon; that spots blemished the bright surface of the sun and by their motions proved its rotation upon an axis, and thereby set forever at rest the epicycle theories of Ptolmey and made real the belief of Copernicus, of an hundred years earlier that the sun—not our tiny earth—was the centre of our solar system.

Thus began the first great epoch of astronomy, originating in the master mind of Galileo, the Italian.

A generation before, Tycho Brahe, the Dane, began recording the relative motions of the stars. For thirty years patiently and laboriously he collected a tangled mass of data, apparently unconnected by law or order.

Then appeared the broad, speculative mind of Johann Keppler. Keppler was of premature birth, and, when a mere child of four, was stricken with smallox. It left him crippled in his hands and almost blinded in his eyes. He proved helpless for the work of the farm and was sent away to study for the ministry. It is marvelous that, with a dislike for astronomy, unskilled in observation and in manipulation because of his childhood infirmity, yet he sorted and classified and interpreted the accumulated observations of Brahe's thirty years and gave to the world the three great mathematical laws of motion—Keppler's Laws—which rule the heavenly bodies.

Thus appeared, almost contemporaneously with the Galilean epoch, another era in science, originating in the master mind of Keppler, the German.

Then, a little over a generation later, Sir Isaac Newton, in England, studying the thirty years' data of Brahe and the three laws of Keppler, read into them the thought that one simple force could explain all of them—gravitation—and the fourth great epoch in astronomy appeared, originating in that master mind of Newton, the Englishman.

To-day it is proved that Newton's force of gravitation rules to the remotest limits of the heavens. It lifts the tides; it draws down the raindrops, and it makes revolve about each other twin stars which are so remote that in the most powerful telescopes of to-day they appear as only minute single points of light. The mind which discovered this force, and which bounded the calculus, was that of a farmer's boy who stood low in his class in the Grammar School. One day a boy above him bullied the timid Newton. Finally Newton armed himself, and thrashed the boy above him. This trivial incident seemed to change Newton completely. It seemed to inspire him with courage and ambition, and he became the head boy of the school. At fifteen Newton was taken from school to become a farmer. His mother's brother, a rector and graduate of Trinity College, Cambridge, persuaded the

*[illegible]

mother to enter him at Trinity. Soon thereafter, at a county fair he bought a book on astrology, but because he, though nineteen years of age, did not understand trigonometry, he could not interpret even the figures of the heavens. So he bought an English edition of Euclid's geometry, but he soon put it aside as "a trifling book," as he expressed it, and because the propositions were "self-evident." Finally he became possessed of Descartes' geometry, and this inspired him to his first introduction to higher mathematics. Newton's life is full of proofs that trivial incidents seem often to be influential in the evolution of master minds.

Let us glance back over biology. Its first great epoch came with the discovery of the circulation of the blood by William Harvey, the Englishman, in 1619. Before his day mystery and superstition surrounded all the phenomena of life. Then two centuries went by and biology knew no progress, until with the perfecting of the microscope it came to learn that all its problems were cell problems. Thus its second great epoch appeared and the names of the Germans—Schleiden and Schwann, of Max Schultze and Virchow—stand out together about the middle of last century. Then came its third great epoch, bearing the imprints of the name of Pasteur, the Frenchman. It is the epoch of the present. Pasteur's discovery that live organisms are the causes of fermentation is the basis of the modern germ theory of disease, and around this theory is the progressive work of to-day.

Pasteur was of humble birth, the son of a tanner. In his school life he was but an ordinary scholar. First upon hearing a lecture by Dumas at the Sarbonne was he aroused to serious study of chemistry. But this simple incident determined his development, and finally he was inaugurated Dean of the Faculty at Lille. In his inaugural he spoke these memorable words: "In the field of observation chance favors only those who are prepared." It is now twenty-seven years since Pasteur delivered that inaugural, but the close of his address seems now almost prophetic. He said:

"Two opposing laws seem to me now in contest. The one a law of blood and death, opening out each day new modes of destruction, forces nations to be always ready for battle. The other, a law of peace, work and health, whose only aim is to deliver man from the calamities which beset him. The one seeks violent conquests, the other the relief of mankind. The one places a single life above all victories, the other sacrifices hundreds of thousands of lives to the ambition of a single individual. The law, of which we are the instruments, strives even through the carnage to cure the wounds due to the law of war. Treatment by our antiseptic methods may preserve the lives of thousands of soldiers. Which of these laws will prevail, God only knows; but of this we may be sure, that science, in obeying the law of humanity, will always labor to enlarge the frontiers of life."

But the greatest epoch in biological science came with the advent of that master mind Charles Darwin, when, in 1859, appeared his "Origin of Species." With it came a radical change in the thought of the world in natural history, and to-day Darwin's "Theory of Evolution" is the guiding principle in every study of organic life.

Let us turn for a moment to physics. With Volta and Galvani, in Italy, began the age of electricity. The battery arose and a new, subtle force was born to science. Its first striking application resulted when the electric arc light shot its first beams from the laboratory of Sir Humphrey Davy in the dingy Albemarle Street of the Royal Institution in London. Davy's mind is well worthy of study. In the grammar school on the remote coast of Penzance it revealed no ability save for verse translations from the classics and for story-telling. Then the father died, and at sixteen the boy was left poor with his mother and six children. He became an apprentice to an apothecary, and in the apothecary shop began his introduction to chemistry. At twenty-four he was Professor of Chemistry in the Royal Institution. At thirty-eight he gave to the mining world his safety lamp, and the coal owners of Newcastle gave to him in recognition of its value to them a silver service. When Sir Humphrey Davy's will was opened it read, the silver service was to be melted into a medal for the most important discovery in chemistry made anywhere in Europe or in the Anglo-American countries. It was sixty years later, in 1877, before this medal was bestowed for the first time, and upon the Germans—Bunsen and Kirchoff—for their era-making discoveries in spectrum and analysis. Thus around Davy's mind centred the second epoch in the progress of physics. During this time, in Davy's laboratory, there was developing one of the greatest of the master minds of the Nineteenth Century, the son of a blacksmith and apprentice to a bookbinder, Michael Faraday. In thirteen days of unparalleled experiment, Faraday created a third epoch which encompassed every branch of science. He discovered that a magnet or current of electricity could originate another current in neighboring conductors. This was the starting point of the dynamo and the motor of to-day, and nearly everything that is known about electric inductions was disclosed in that half month of experiment.

To Faraday's prescient mind it was impossible to conceive of the electric forces as acting at a distance, except by means of some medium—an ether. Thus it was under Faraday's inspiration that there began those researches upon the properties of the ether, around which, to this very minute have centred the highest scientific thought. Faraday's epoch was but the precursor of those great periods of the Nineteenth Century when Clerk Maxwell and Heinrich Hertz were loaned to the world. Never before had science advanced so boldly. In Maxwell's well known electromagnetic equations lie nearly all our modern knowledge of light as an electric happening in Faraday's ether. Twenty years later, out of the mathematical thought of Maxwell, came the brilliant experiments of Heinrich Hertz, which gave to the world all the principles of electric radiation, by which has been made possible the art of wireless telegraphy.

Then came two striking epochs to mark the stride of science through the Nineteenth Century, the Conservation of Energy and the Second Law of Thermodynamics. With these come to us always the names of Helmholtz and Clausis respectively. It is not the place here to dwell upon the impulse and swing which these two broad principles have given to science.

It is strange, but the search for a reason why perpetual motion is absolutely and forever impossible led to the discovery of the conservation of energy by Helmholtz, while it is perhaps equally strange to realize that first to-day, after half a century, scientists are beginning to grasp the full meaning of that second law of thermodynamics of Clausius—the Law of Entropy, so-called.

With the close of the Nineteenth Century began the great epoch which is now in its making. Men claim it, I have said, as our age of science and invention. Looking back we can see that it is clearly the epoch next in succession from Faraday, Maxwell and Hertz. Logically, therefore, it had to be electrical. You recall that first has come the discovery of the X-rays, which are but electrical radiations; then the discovery of the electron, which is the atom of electricity; then the finding of radioactive substances, disintegrating into electrons and radiations;

and lastly that most recent theory—even now challenging attack—that energy itself has a physical structure and that it is atomic in its nature, thereby placing it in the list of substances. With these brilliant discoveries will always come to us the name of Roentgen, in Germany; Marconi, in Italy; Sir James Thomson, in England; Mme. Curie, in France; Rutherford, in Canada, and Max Planck, in Berlin. These are the brilliant minds in the physics of to-day.

It would seem then that master minds had created the great epochs in science and are responsible for its astonishing progress.

Is it not highly probable, then, that future progress will be similarly characterized by brilliant epochs and by the advent of other master minds, minds perchance even now unfolding somewhere in their making?

If this be true, it forces another question, What are master minds? Have they some common characteristic by which to identify them? Are they synonymous with genius? It is not easy to define genius—perhaps impossible. But surely the mind of a genius is one-sided; it is unsymmetrical. Whether by environment or by training, it has come to outstrip other minds in some one direction. It has either enormously extended knowledge along some one branch, or abruptly blocked it from false paths. The master mind, to some degree at least, seems to bear the stamp of genius. It also discloses an unsymmetrical aptitude. It has always pushed in the direction of its own peculiar bent. It has always been a leader. We become its helpless followers. Often unconsciously, but always unerringly, we have recognized its dominancy.

It would seem patent, then, that a mind which has, in potentiality, the possible making of some future epoch, would divulge somewhere or at some time in its development a dissymmetry. A keen observer and experienced educator might detect this.

It must be true that somewhere in our land, in the schools of our cities, and even in those of the remote and scattered country districts, there are to-day young minds in which there are traces of this inborn gift of mental leadership. Remember, it is given sparingly, only here and there, only now and then. The overwhelming majority of mankind possess it not.

But we know it is given to some, and it is worth the while to each one of us to lend his aid to its discovery, if possible. Who can tell what slightest incident may prove the turning point in a life. So I feel right in saying that there is a chance that a marked dissymmetry in mental faculties may be the very hall mark of the gift of genius.

So I ask, should there not be in our scheme of education special stress laid upon unsymmetrical minds, if such be found? Would not one-sided development, if pushed to its limit, bring highest results for such minds? But this upsets our school traditions. Symmetrical development of all mental faculties has been our ideal in education. Minds have been squeezed into a common mould, turned out after a common type. To say that one can generally pick out a college bred man is not necessarily complimentary. Nature does not bear her varied fruits on a single tree type. So I say, whenever we find some marked dissymmetry in mental faculties we should push its development to the full.

Of course I do not mean in the ordinary foundation work of our secondary and high schools. I have in thought the university and the technical schools. Here the student mind first grows conscious of a special vent, if it has any. Here, generally late in his course, a student begins to "find himself," but only in later, actual life, does he really "prove himself."

Rarely has an undergraduate accomplished anything original in science, or made any real addition to knowledge. The best he can do is to begin a development in the direction of his aptitude. So I will press the thought further. The world has always been led. The world has always had leaders; conquest and commerce, art and religion, science and invention have always been in the hands of leaders. Great leaders have come indiscriminately alike from humble rank and from high birth. Remember Newton, the farmer's boy; Brahe, the Dane of noble family; Pasteur, the tanner's son; Liebnitz, the son of a professor of moral philosophy. The father of Keppler was a soldier of fortune and his mother uneducated and undisciplined. Recall Faraday, the son of a blacksmith and himself a bookbinder's apprentice; Descartes and Napier, both of high rank and education; Hertz, the student of engineering in Munich; Helmholtz, the son of a professor and himself originally a surgeon in the Prussian army; Vorchow, the son of a small farmer, while Darwin's grandfather was a famed botanist and his father a physician. Neither royal blood nor heredity have been proved as dominant factors. Leadership has defied country, and ancestry, and environment. It is a God-given gift.

The world will always demand leaders, and for their making the world must naturally look most expectantly toward her highest schools. The day of the untrained mind in science or invention has gone by.

I do not consider it presumptuous to suggest that among a body of students, such as these we have here, there is a chance that there may be some one mind with an exceptional aptitude for some phase of science. Its possessor may be but vaguely conscious of his priceless possession. He may be merely aware that somewhere in his school course some particular subject held a particular claim for him. He knew he liked it, but he could not explain why. It seemed easy to him, but he did not know the reason the subject appealed to him, and once in a while what seemed like a mental thrill flashed through him as he penetrated deeper and longer into that particular subject. It was not the thought of compensation; not of a possible success: it was just the subject itself, just the pure and simple new knowledge of something revealed to him. If anyone has once felt that thrill, he knows that he has made a discovery. He has found his mind. He has revealed to himself a mental gift—a talent entrusted to his keeping.

But what of it? Suppose that he has discovered his talent. The future augurs almost invariably—the common experience of young graduates—the struggle for a livelihood. Everything drops out before it.

It is not my purpose to dwell upon this phase; everyone understands it too well. I am not thinking of the thousands of young men going out from the universities and the professional schools about this time of year, who will soon disappear in the complicated machinery that grinds out the world's work. I am interested in that mind with the undeveloped trace of genius in its make-up. I do not assert that it is in this school. But there are such somewhere. If it is given to any one of you, it is worth your while to make everything in the future subservient to it. Never mind if you go to-morrow to [illegible] in the mills, you can afford to wait, you can make your opportunity; you can find a way to keep alive that inborn faculty until you can [illegible] It is not necessary that the engineering product should remain an engineer. He may become one. Engineering training is proving itself more and more a fitting preparation for any business or profession. I sometimes feel that the young engineer has more than

an equal chance to be one of these gifted ones in whose mind lies that inspiration which forced the epochs of the past.

Tyndall was first an engineer; Hertz was first an engineer.

I sometimes fear, however, that we are drifting toward an idea that the engineering school is exempt from that fundamental conception of all education that the highest development of the individual carries with it an added responsibility for the uplift of society. The engineering school and the university stand side by side. The raw material is the same. The finished product of each is finished only in so far as each turns out MEN—men into whose eyes we can look straight.

It is hard to drive home the fact that the strength of a school lies largely in its ability to train. If it has been able to reveal to a student something of himself, it has done well for him. If it has been able to awaken some talent—previously latent in some mind—and to start it forward on its development, it has performed an additional service because that individual mind may have within it the very elements of leadership.

So I say we have a right to expect of our schools leaders for the future of science, but they will come, as they have all through the past, from the farm, from the city, from the poor, from the rich, from the high born, from the humble.

The gift of the master mind knows no country, no ancestry, no environment.

Commenting editorially on recently published discussion concerning the encouragement of the Canadian prospector, "Mining Science," of Denver, Colorado, observes: "In contrast with the attitude usually accepted in the United States, our Canadian friends lean frankly to the theory of state encouragement, even through subsidies. This policy has been pursued in other British colonies, especially in Australia. Special inducements, as one contributor expresses it, must be offered to revive interest in prospecting. State aid is easily suggested and oftentimes readily secured. Yet experience does not produce much argument in favor of this policy as applied to the work of the prospector. Paternalism is always suggestive of interference. The moment the state offers its services to an industry or to a class, it is apt to demand compensatory powers which serve to defeat the original purpose. The true stimulus to prospecting is the largest measure of freedom. Liberty to wander unmolested, to search without red tape or questionings of any kind, is the real foundation of mineral development. This is the thing that appeals most to the heart of the man in the field. Nevertheless we find men of high intelligence and broad education attempting to solve the problem in hand without any regard for the human factor in it. We may legislate and regulate and appropriate money and chew our ponderous words in support of happy theories; but we fail in all our efforts if we forget the primary fact that free access to the earth is the inspiration that develops the wilderness and brings forth its fruits. Among the first commands to be found in the pages of Christian Scripture is this: "Subdue the earth." Society has too often overthrown that mandate through the greed and stupidity of those who participate not at all in the grand work of subduction. The Canadian Government has not gone so far as our own in hampering the feet of the frontiersman, but Canadian citizens are apt to be led astray by parlor discussions.

GOLD DEPOSITS OF NEWFOUNDLAND AND LABRADOR

By J. W. McGrath.

Only the barest and most general knowledge is yet available of the minerals that are found in Newfoundland. It is a very striking fact that all the mines that have yet been worked were discovered not by experts or prospectors, for as yet the country has been visited by very few if any such.

The little prospecting that has yet been done has been almost entirely confined to a few miles from the sea coast. What the interior of the country holds in mineral ores is yet a closed book. Now and again finds of gold have been made, but little or nothing has ever been done to ascertain fully the value of the finds.

In all the copper mines that have been worked in the country varying proportions of gold have been extracted and although gold has not yet been mined for any length of time, yet the amounts of the metal that copper ores have yielded give positive indications of the presence of gold in quantities. All over the island free gold has been found, usually in quartz veins, and analyses indicate that some, if worked, would yield good returns.

Ten years ago operations began on a mine situated at a place called Mingo in the northern end of the island. The lode was a mixed one. It was composed of magnetite, pyrite, quartz and jaspery slate rock. Twenty tons of the ore was first mined and subjected to a trial assay. The yield of free gold was ten and a half ounces and in addition to this slimes contained a value of $55. Work was continued, and a shaft was sunk to a depth of about 100 ft., and a drift run along its course for a length of another 100 ft. A number of assays were then made of sample lots taken from varying depths and gave an average result of $12.40 per ton. Besides this two gold bars were produced of 11 and 37 oz. respectively. The finances of the promoters were now exhausted and sufficient capital was not forthcoming to continue the work, and perforce operations were discontinued and nothing since has been done on the property.

About the same time, in another part of the country, in White Bay, another attempt was made to mine gold-bearing quartz in a talcose schist. During the preliminary operations 150 oz. of gold was secured, but lack of interest by the people in the work and the consequent failure to raise sufficient money to go on with the attempt led to a discontinuation in this mine also. Other instances somewhat similar occurred from time to time. Lack of finances has crippled one after another. The geological survey of Newfoundland for 1900 says: "Quartz veins are numerous all over the island; but no systematic prospecting for gold by persons well skilled in that particular business has ever taken place."

As already stated the copper mines have all given a yield of gold. The Tilt Cove copper mine, which has been worked for fifty years, is known to produce about 1½ dwts. to the ton, which has been recovered in the reduction of the ore. No statistics relative to the actual amounts or the value can be procured, but for years it varied between 3,000 and 5,000 oz.

It is almost pathetic to record that on the Labrador coast geological work that has yet been done would not be made to fill a small volume and the research given to gold-bearing ore would hardly fill a page.

A wonderful deposit of gold was discovered there about fifteen years ago, and the promoters were sanguine of extraordinary developments. The location of

the find was popularly believed to be at a harbor on the sea coast named Hebron. A very expensive expedition was fitted out for the operation of the mine. Expensive apparatus and the most up-to-date equipment were provided. The vessel which carried these fittings never reached her destination and the mine still remains inoperative.

Dr. Wilfred Grenfell, who has spent years on the coast, says: "Indications of the mineral value of Labrador are practically in sight from the sea. No serious search for the treasures of the endless miles of Labrador has ever been undertaken."

Farther north towards the Hudson Bay limits, John Armstrong, chief engineer of the Hudson Bay Railway, who travelled through the greater part of this whole region, states: "Various specimens of the precious metals have been shown to our engineers; but the origin was preserved in so much mystery that they could not be treated as evidence of the metal in that territory."

There cannot be any doubt whatever that in a few years mines will be developed and worked with profit in a number of these localities. But it will first necessitate the people being educated to a knowledge of the nature of these deposits and the way to open them. When they come to realize that money as well as knowledge is a prerequisite to a commencement of such work then there are possibilities, and not remote ones either, that the next rush for gold might be into these regions.

MINERS' UNIONS IN CANADA*

(Continued from last issue)

Provincial Workmen's Association.

The oldest wholly Canadian craft labor organization in the Dominion is the Provincial Workmen's Association, a body of miners whose activities are confined to the coal fields of Nova Scotia. From the inception of the coal mining industry in Nova Scotia, the miners, as far as the records of the department show, were without any form of organization until the formation of the Provincial Workmen's Association. The iniative in organizing the miners in Nova Scotia was taken in Springhill, Cumberland county, on August 29, 1879. At a largely attended meeting of miners it was unanimously resolved to form an association to defend and protect the interests of the miners and other workers about collieries. Mr. Thomas Leadbetter was elected president; Mr. Robert Drummond, now member of Legislative Council of Nova Scotia, was chosen secretary and agent; a committee consisting of Messrs. R. Wilson, James Wilson, Samuel Wilson, Simon Fraser, Alex. Ferguson, John Dooley, Wm. Boran and Alex. Ross, was appointed to act with the president and secretary to draw up a constitution and code of rules and by-laws for the governance of the association.

At a subsequent meeting, on the evening of the same day, the above mentioned committee, having formulated rules, etc., was organized into a provisional Grand Council to exercise the functions laid down in the constitution until such times as a Grand Council was legally constituted by the appointment of duly certified delegates from the various lodges which it was expected would shortly be instituted. The first local lodge formed was Pioneer No. 1, organized at Springhill on September 1, 1879. During the next two months three local lodges had been organized at the Pictou collieries, on October 17, 1879, delegates were sent by these lodges to Truro, where the first meeting of the Grand Council of the Provincial Miners was legally constituted. In March, 1881, the association was incorporated by an Act of the Nova Scotia Legislature under the name of the Provincial Workmen's Association. In the same year the employees of the Cape Breton collieries were organized. The lodges in the district held semi-annual meetings under the head of a sub-council, which had full authority in the Cape Breton region. The Grand Council and the sub-council met separately and semi-annually until the year 1890, when more complete railway connection permitted these bodies to assemble in one body, annual meetings taking the place of the semi-annual gatherings.

Until the year 1883 none but workmen employed around the collieries and at the coal piers were taken into the association. In that year application for a charter was made by the glass blowers of Pictou county, and they were formed into a local lodge. Later a lodge of iron workers was organized, and in 1897 the boot and shoe workers of Amherst joined the association. In 1898 the Knights of Labor contested ground with the association, but unsuccessfully. With the exception of this incursion on the part of the Knights of Labor, the P. W. A. had little opposition in its territory from any other labor body until the year 1908, when the United Mine Workers of America, which had some years previously established itself in the coal field of the Crow's Nest Pass in Alberta and eastern British Columbia, entered the Nova Scotia coal regions by forming a lodge at Springhill, the locality in which also the P. W. A. had its birth. The lodge, which is known as No. 469 of the U. M. W. A., was organized in December, 1908, the mine working members of Pioneer and Mechanics' lodges of the P. W. A. going over in a body to the new lodge. Other lodges of the U. M. W. were later formed in various localities.

In the early years of the previous decade the Provincial Workmen's Association gained considerable strength, every colliery in the province of Nova Scotia being organized. In addition to miner's lodges, branches composed of railway men, steel workers, tramway men, retail clerks and other classes of wage-earners were formed, so that at one time more than one hundred classes of workmen were represented in the organization, and instead of being a craft union the association became an industrial organization.

With such a varied body of workmen it soon became apparent that the P. W. A. had assumed a task for which it was hardly intended. The P. W. A. had not apparently made any organized effort to bring these classes into its fold; they had entered of their own volition, and mainly, no doubt, because no other organized body represented their trade in the immediate vicinity. For a time the executive of the P. W. A. did its utmost to perform the duties of a union to the various classes which had affiliated, and met certainly with some success. In 1909 a dispute arose at the Sydney steel plant over a collection of wages which had

*Extract from the Fourth Annual Report of the Department of Labor, Canada.

ly resulted in a strike. The P. W. A. took the course which seemed best to it in maintaining the strike, which, however, failed. For four years longer the association retained its industrial features, but the membership did not develop along the lines of industrialism. When lodges outside of the collieries lapsed they were not reorganized, and the P. W. A. gradually reverted to its original type, viz., a coal miners' union.

In the early years of the Provincial Workmen's Association wages were low and progress in wage increases necessarily slow owing to the state of the coal trade and the condition of the country. The eastern coal trade partook, however, of the general prosperity of the country, and wages began to increase somewhat rapidly. Perhaps the efforts of the P. W. A. had some effect in this direction. At any rate the association took some credit for improved conditions, which it sought also by actively promoting legislative reforms.

It may be of interest to note the entry of Mr. Robt. Drummond, the first grand secretary, into the association. One month previous to the formation of the society the men at Springhill mines had ceased work as a protest against a second reduction in wages within a short period. Mr. Drummond, who was a Halifax newspaper correspondent, took the side of the men by public speech and with the pen; it is said, as a result, he lost his position. At the organization meeting of the association Mr. Drummond applied for admission and was welcomed into the gathering. He was elected grand secretary, a position he held for nineteen years. At the time (1879) the association was formed, unions had very few friends in the press, and it was thought advisable to start a journal to spread the news and views of the society. The first proposal was that it be a joint stock affair, the members to be the shareholders. A plant was purchased by the secretary, but the subscriptions to the capital stock did not reach $20. He, therefore, financed the undertaking alone for a time. In 1898 Mr. Drummond severed his connection with the P. W. A. and began the publication of the Maritime Mining Record, a journal, no longer a union organ, but distinctly commercial in character, though frequently containing information of particular interest and value to coal miners. Mr. Drummond is now a member of the Legislative Council of the Province of Nova Scotia.

The objects of the Provincial Workmen's Association, as laid down in the constitution, are as follows:

1. To advance materially its members, by promoting such improvement in the mode of remuneration of labor as the state of trade shall warrant or allow, and generally to improve the condition of workingmen morally, mentally, socially and physically.

2. To shorten the hours of labor, to strive in obtaining better legislation, whereby the more efficient management of mines and other works may be effected—thereby securing the health and safety of the workmen—and in enforcing such legislation as already exists.

3. To secure the true weight of the miner's output at the pit head, to assist in abolishing all illegal stoppages at pay offices, and recovering the prices and wages bargained for by its members as an equivalent for their labor.

4. To foster habits of thrift, industry, economy and sobriety among its members.

5. To secure compensation for injuries received while at work—where the employers may be liable.

6. To extend support to lodges and their members who may be locked out by their employers or forced into discontinuing work on account of insufficiency of wages or for any unjust cause whatsoever.

The chief features of the scheme of organization of the Association are briefly as follows:

The Grand Council, as the chief governing body is called, is composed of delegates elected by the local lodges, the term of office being for six months. Each local lodge is entitled to one delegate. The officers of the Grand Council consist of a grand master, associate grand master, grand secretary, grand treasurer, grand chaplain, grand guardian, grand inner watchman and grand outer watchman. The meetings of the Grand Council are held at such times and places as may be most suitable. The annual meeting is held in September, at which time the Grand Council officers are elected by a delegate vote.

Where mine operators make any change in working conditions, or attempt to make alterations whereby the wages of members of any lodge are reduced, or where through such change the interests of the members are affected in any way, the lodge concerned is required to lay all the facts before the grand secretary, who may ask for all evidence in the matter, to be presented to a special meeting of the Grand Council if such is deemed necessary. No lodge or portion thereof is allowed to cease work with a view of striking unless such action is sanctioned by a majority of legally appointed Grand Council delegates in session assembled. Any lodge striking without the sanction of the Grand Council, Grand Council committee, or sub-council, forfeits all claim to support, and may have its charter revoked. Lodges are not allowed to enter into contract concerning wages or hours of labor without first submitting the whole of such proposed contract to the members, and obtaining sanction of the majority, the vote to be general and secret. Where accidents to members have occurred through the neglect or liability of employers, the Grand Council may appoint counsel to take the necessary steps to recover damages. Members who have been dealt with contrary to the rules of the lodge may appeal to the Grand Council, whose decision in the matter shall be final. Any member or members at variance with their lodge, and who are desirous of forming a new lodge, must first secure permission from the council. The association cannot be dissolved so long as one lodge with forty members in good standing shall object thereto. The constitution provides for three sub-council districts, known, respectively, as Cumberland, Pictou and Cape Breton districts. These sub-councils have power to make rules and by-laws for their own governance, provided such do not conflict with the constitution.

P. W. A. Strikes—The association had been in existence but a few months when a dispute arose which concerned the members of Cameron lodge at the Drummond colliery in Westville. The issue related in the first place to reduction of wages, but later developed into the question of recognition. Sanction of the strike was opposed by the grand secretary, on the ground that all efforts at a peaceful settlement had not been exhausted. This view was relaxed when it was made to appear that if sanction were refused the lodge would be dissolved. The strike barely started when it was reported to the grand secretary that certain members, in order to frighten the mine manager into submission, had proposed to fire shots close to the windows of the manager's residence. These men were informed that if anything of this nature was attempted either the charter of the lodge would be revoked or it would be necessary to secure another secretary. A strict watch was kept on the men during the

night, and nothing further was heard of any such methods. The manager of the colliery, however, fearing violence, made application for the militia, which was granted. No disturbances occurring, the soldiers fraternized freely with the strikers and engaged with them in various games and sports. No settlement being reached, the matter came before the directors in Montreal. The directors, a little later, visited Westville and conferred with the lodge committee, with the result that the P. W. A. secured the coveted right of having duly appointed lodge committees wait on the management, the measure of recognition obviously necessary before a union can negotiate. This dispute continued only a few weeks.

In 1882 a strike occurred at Lingan colliery, Cape Breton, and continued for one year, and ended favorably to the men. Workmen, it appears from the records of the time, were brought from Scotland to take the places of the strikers, but the newcomers, on learning that a strike was in progress, had refused to go to work, joining the strikers. The militia was again called out, but as at Westville their services were not required. The outcome of this strike is uncertain, no particulars having been preserved so far as can be discovered.

On November 5, 1900, an executive meeting of the miners of Nova Scotia was held in Sydney and the owners of fourteen collieries were asked to give their employees (mechanics and helpers excepted) an advance of 12 per cent., to take effect on January 1, 1901. For mechanics, carpenters and blacksmiths an increase of 50 cents per day was requested, and 25 cents per day for helpers. In some mines the increase was readily conceded; in other cases it was not until a strike seemed imminent that the increased scale was granted. The miners went on strike in several cases, about 1,500 men in all being affected. The strike lasted only five days, when the demands of the men were conceded in full.

On December 1, 1903, the miners at Springhill, to the number of 1,650, went on strike against a change in the company's method of payment. The strike was settled on December 7, the men accepting the change conditionally. The company claimed that the strike had been contrary to the rules of the union and of the working agreement, which provided that no strike should take place save on fifteen days' notice, a view which the union seems to have admitted.

On June 1, 1904, the association was involved in a strike of the steel works employees at Sydney, N.S., to the number of 1,500. The cause of the dispute was the refusal of the company to grant a demand for a restoration of the scale of wages paid prior to December 1, 1903. During the first month of the strike there was little trouble. When, early in July, the company made an effort to resume operations it was reported that the local police were inadequate to give the protection deemed necessary, and the militia were called out. The dispute was finally settled under the Dominion Conciliation Act, the strike being declared off on July 22. It will be remembered that up to this time the P. W. A. included other classes of labor than coal miners.

During the year 1905 no less than three strikes took place in Springhill district. The first occurred on June 13, about 1,700 men being affected. The cause of this dispute was the objection of the local lodge to the treatment of a disabled workman who had been discharged from a position in the lamp station for alleged incompetency. The company offered other employment at current rate of wages, but the offer was refused. Later the offer of the company was accepted by the local lodge, and the strike was declared off, the men returning to work on June 22. The mines at Springhill were again closed on July 7 and 8, and also on July 13 and 14, owing to a strike of 150 boys employed in the mine, the cause of the dispute being the suspension of a trapper boy for neglect of duty. The company laid a charge of conspiracy against the suspended boy, promising to reinstate him no matter what the result of the trial might be. On July 15 the boy was acquitted and no further trouble occurred with regard to the matter. On September 26 the association was involved in yet another strike at Springhill, this time for an increase in wages for firemen, water tenders and engine drivers employed by the Cumberland Railway and Coal Company. The mines were closed as a result of the dispute, some 1,500 persons being affected directly and indirectly. The demands of the men were conceded on the following day, and the strike ended.

On March 16, 1906, a strike involving 400 men occurred at Inverness, the principal cause being the introduction of a docking system. The local lodge refused to accept the docking system, and formulated other demands on the company, which were not entertained. After being out for a week, work was resumed, the matter in dispute being referred to the grand sub-council of the association. Some of the men's demands were conceded, and it was stated that others would be granted later. On May 9, a strike took place at River Hebert over the refusal of the employing company to allow a chain runner to do the work of loading in lieu of granting him an increase of 10 cents per day. On May 24 the 150 men affected returned to work, the company having granted the demand at the request of the local lodge. On July 2 the coal boys at Springhill declared a strike, which affected 1,400 persons, owing to a dispute over wages. The strike was ended on July 6, the employees having secured a satisfactory settlement. On November 20, Springhill was the scene of another strike of 600 underground workers (not including miners, who, however, to the number of 900 were indirectly affected by the strike). The cause of the dispute was the transfer of two employees to another part of the mine, and the refusal of the company to reinstate them in their former positions. The strike was terminated December 3, the strikers returning to work unconditionally. On November 6 a strike of miners employed by the Intercolonial Coal Company of Westville took place owing to the refusal of the [illegible] to deal with nonunionists. On November 8 the nonunionists became members of the local lodge of the association, and the strikers, numbering some 850, returned to work.

In 1907 the Provincial Workmen's Association was concerned in five strikes, three of which were against the employment of non-unionists. The first of these took place on February 4, 1907, at Sydney, about 1,000 men being affected. The second strike took place on March 19 at Bridgeport, and involved 900 men. After a week's idleness, during which time the nonunionists became members of the P. W. A., the men returned to work. On April 1, 1,700 employees of the Cumberland Coal Company at Springhill went on strike on account of objecting to working with nonunionists. On learning that their action was a violation of the Industrial Disputes Investigation Act, which had been recently passed, the men returned to work on April 8, all the nonunionists having joined the [illegible]

tion in the meantime. The local lodge made application for a board under the Industrial Disputes Investigation Act, being the first request for the invoking of the law, but as the men returned to work, it was not necessary to take further steps in the matter. On August 1 a strike again occurred at Springhill in which about 1,250 men were involved. The dispute arose on account of the employees' claim for payment of a certain rate for stone in pillar work being disallowed by a Board of Conciliation and Investigation which had been established in June under the Industrial Disputes Investigation Act to inquire into certain differences existing between the men and the company. Both majority and minority reports were presented neither of which were acceptable to both parties. Efforts were made by many public men to bring about a settlement of the trouble, and after inquiries as to the possible reference to a board of matters remaining in dispute, the men resumed work on October 31. On September 21 the employees of the Acadian colliery at Westville to the number of 325 went on strike for a short workday on Saturdays. On September 26 the strikers resumed work without the concession being granted.

The only strike in which the association was concerned during 1908 occurred on May 1 at Port Hood, and arose from the refusal of the company to grant an increase in wages of 15 per cent. in accordance with a demand of the Grand Council. On May 5 the strikers, numbering about 300, returned to work, the matter in dispute being referred to a Board of Conciliation and Investigation under the Industrial Disputes Investigation Act. The Port Hood miners again went on strike on March 22, 1909, over a question of wages. The strike was terminated on April 12, the terms of settlement not being reported.

A strike, which lasted a month, occurred on May 5, 1909, at the Drummond colliery in Westville, over the demand of about twenty drivers for increased wages. The stoppage of work by these drivers affected some 700 employees. On June 2, at a meeting of the local lodge of the association, a vote was taken which resulted in favor of resuming work.

In the strike of the United Mine Workers for recognition, which took place in Glace Bay in July, 1909, the Provincial Workmen's Association was brought directly into conflict with the international body. The P. W. A. had for many years exercised jurisdiction over the miners in the district, and at the time of the strike the company concerned in the dispute had an agreement with the association covering the conditions of employment, etc., of its members. During the strike much bitterness was displayed between these two bodies, and when the mayor of the town protested against the militia being sent to the strike zone the P. W. A. took exception to the attitude of the mayor and urged the dispatching of troops in order that their members who desired to work would be accorded proper protection. The P. W. A. appears to have retained substantial control in the district, although the U. M. W. still has a few local branches in the locality, with a small membership.

Since the passing of the Industrial Disputes Investigation Act in 1907 the association has taken advantage of the law, and through its provisions many disputes have been settled. This line of action is believed to have contributed to the comparative freedom from strikes during the last few years in the district through which its interests extend. Two-thirds of the coal now mined in the province of Nova Scotia is paid for on a wage rate drawn up six years ago by a Board of Conciliation and Investigation appointed under the Act.

At the close of 1911 the membership of the Provincial Workmen's Association was reported at 4,000, being comprised in twenty-two local lodges. For the years 1912 and 1913 the membership was given at 5,000, and twenty-three lodges. For 1914 the membership was reported at the same figure with twenty lodges.

MONAZITE, THORIUM AND MESOTHORIUM.

"Monazite, Thorium and Mesothorium," is the title of Technical Paper No. 110, by Karl L. Kithil, mineral technologist, just issued by the U. S. Bureau of Mines. In this paper it is stated that there exists a possibility that resources of monazite can be used profitably in the manufacture of the chemical products, thorium and mesothorium. Thorium nitrate is used extensively in the manufacture of incandescent gas mantles; mesothorium has been successfully employed in therapeutics, its properties being similar to those of radium.

Most of the monazite imported by the United States in late years has come from Brazil, where the mineral occurs in the beach sands along the coast of certain states and where it could be mined more cheaply than from inland placers. The mining of monazite in the United States has been practically at a standstill since 1906, especially since the price for thorium nitrate was reduced by European manufacturers to such an extent that it could be imported more cheaply than it could be made here, and this in spite of an import duty of 25 per cent. ad valorem on the salt. In former years, especially previous to 1906, there existed considerable activity in the monazite belt of North and South Carolina, and many hands were employed to mine the mineral. Since then practically no mining of this mineral has been done in these and other states where monazite occurs.

Mesothorium can be obtained as a by-product from thorium nitrate manufacture, and this may help the American manufacturer to utilize domestic resources at least to some extent.

The paper contains a full description and references to occurrences of the mineral in the United States and the methods used in the mining of monazite sands are thoroughly discussed. The best methods for the separation of monazite from other heavy sands are given, together with flow-sheets and other technical details.

A short outline of analyses for thorium is given and the methods employed in the chemical manufacture of thorium nitrate and mesothorium are referred to. The complete history of the development of this industry is of interest and is brought out in detail. It is of further interest to know, for instance, that in spite of the wonderful development and increased use of the metal filament lamp the consumption of incandescent gas mantels has increased.

Valuable points for the examination and valuation of monazite deposits are outlined in the paper. Monazite is found in the states of North and South Carolina, in Idaho and in the black sands of the Pacific slope.

Copies of this technical paper may be had by applying to the Bureau of Mines, Washington, D.C.

Another shipment of refined silver from the Consolidated Mining and Smelting Co.'s electrolytic lead-silver refinery at Trail was made last month from Vancouver, B.C. This lot was consigned to China, for coinage purposes; its value was reported to be about $50,000.

PERSONAL AND GENERAL

The Cobalt branch of the Canadian Mining Institute has invited the Porcupine branch to visit Cobalt on September 16 and 17.

Mr. Justin S. DeLury, a graduate of the University of Toronto, and for some years on the staff of the University of Idaho, has accepted a position as lecturer in geology at the University of Manitoba.

Mr. John Knox, general superintendent of the Calumet & Hecla mines, has returned to Calumet from Hamilton, where he attended his father's funeral.

Mr. D. M. Steindler, Mr. M. B. Davis, and Mr. A. G. Kirby visited the Dominion Gold Company's mine in Munro township last week.

Mr. A. R. Whitman has been engaged by Cobalt mining companies operating north of Cobalt lake to make a study of the structural geology in that vicinity.

Mr. C. Miller and Mr. T. H. Rea, of Toronto, have been visiting properties in Northern Ontario.

Capt. H. C. Anchor is again in charge at the Dome Extension, Porcupine.

Messrs. Smith and Durkee, Sudbury, have secured a contract for diamond drilling at the North Dome mine.

Mr. F. L. Sherrill was in Porcupine recently and visited the Martin claims, where it is said development work is to be undertaken shortly.

Mr. A. G. Kirby is manager for Dominion Gold Mines, Ltd., the company organized to work the Dobie-Leyson claims in Munro township, recently acquired by shareholders of Dominion Reduction Co.

Mr. Percy Hopkins of the Ontario Bureau of Mines staff is at Kowkash, Thunder Bay district, examining the gold discoveries recently made there.

Mr. J. H. Stovel, of the Mond Nickel Co., formerly in charge of the Frood Extension, is opening the Bruce Mine for the Mond Co.

Mr. Vannoy H. Manning has been appointed Director of the U. S. Bureau of Mines, succeeding the late Dr. Holmes.

Mr. A. G. Kirby has returned to Cobalt after a visit to Toronto and New York.

Mr. C. H. Poirier is consulting engineer for Dominion Gold Mines, Ltd., operating in Munro township.

Mr. Chas. A. Banks, general manager of the Jewel-Denero Mines, Ltd., has returned to the Jewel mine, near Greenwood, B.C., from a trip to Cobalt and Porcupine districts and thence to Chicago, St. Louis, Kansas and Salt Lake City.

Mr. Darsie C. Bard, professor of geology at the Montana State School of Mines, Butte, Montana, was in Victoria, British Columbia, late in August, on his return journey from Atlin in the northern part of that province.

Mr. J. W. Bryant, formerly mining engineer for the Tyee Cooper Co. in British Columbia, is now in Cornwall, England, after having been for some time at the property in Siberia of the Spassky Copper Mine, Ltd.

Mr. D. B. Dowling, of the Geological Survey of Canada, will present a paper on the Correlation and Geological Structure of the Alberta Oil Fields to the meeting of the American Institute of Mining Engineers to be held in San Francisco, California, on Sept. 16-18.

Mr. R. F. Segsworth, of Toronto, and Miss Mabel Dalton, of Kingston, were married on August 31. On the preceding Friday Mr. W. E. Segsworth gave a dinner at the National Club in honor of his brother. About forty friends, including many well-known mining men, were present.

Mr. Geoffrey B. Kitto, who prior to the closing of the Tyee Copper Co.'s smeltery at Ladysmith, Vancouver Island, British Columbia, was superintendent of the works, last month arranged a mineral exhibit sent to the annual exhibition in the city of Vancouver by the British Columbia Department of Mines.

Mr. J. M. Macoun, of the Geological Survey of Canada, was in Victoria, B.C., at the end of August.

Mr. Dudley Michell, instructor in First Aid and Mine Rescue work for the British Columbia Department of Mines, has been requested to act as one of the judges at the Mine Rescue competition to be held shortly at the Panama-Pacific International Exposition at San Francisco, California.

Mr. M. K. Rodgers, now of Santa Monica, California, in August visited the Granby Consolidated Co.'s mines at Phoenix and smelting works at Grand Forks, British Columbia. He is now a director of that company.

Capt. John L. Retallack, of Kaslo, B.C., long actively connected with mining in Ainsworth and Slocan mining divisions of West Kootenay, British Columbia, is now in England with other soldiers from that province.

Mr. S. I. Silverman, of Spokane, Washington, well known in the Northwestern States and on the Western Canadian coast in connection with mining, is arranging to send into the Stikine mining division of British Columbia supplies for a party of men who will spend some time in prospecting and developing mineral claims in that country.

Mr. Charles F. Schnepp, of Cobalt, has been proposed for membership in the American Institute of Mining Engineers.

Mr. R. H. Stewart, of Trail, B.C., general manager for the Consolidated Mining and Smelting Company of Canada, Ltd., has been in Ottawa in connection with the proposed establishment of metal refining works in British Columbia.

Mr. John Vallance, for several years superintendent of the Standard silver-lead mine, near Silverton, Slocan Lake, British Columbia, has returned to Twodot, Montana, from a visit to his family resident at New Denver, B.C.

Prof. T. L. Walker, of Toronto University, has been spending a week or two in Kootenay district of British Columbia.

Mr. E. G. Wallinder, managing director of the Kamloops Copper Co., has returned to Duluth, Minnesota, after having been for a time at the company's Iron Mask mine, near Kamloops, B.C.

Mr. Alfred R. Whitman, of Timmins, Ontario, has become a member of the American Institute of Mining Engineers.

Mr. George Williams, for several years superintendent of the British Columbia Copper Co.'s smelting works at Greenwood, Boundary district, is now with the Anaconda Copper Co. at its big Washoe smeltery in Montana.

Mr. Conrad Wolfe, of Spokane, president and general manager of the United Copper Co., operating at Chewelah, Washington, recently became a member of the American Institute of Mining Engineers. About two years ago he located two stamps of copper claims on Vancouver island, British Columbia, one of which was afterward transferred to Mr. Maurice W. Bacon, manager of the Stewart Mining Co., operating in the Coeur d'Alene district, Idaho.

Mr. R. G. McConnell, Dominion Deputy Minister of Mines, when in Nelson, B.C., about the middle of August, met several members of the Industrial Committee of the local Board of Trade, who made representations to him relative to the mining industry of the district. Mr. O. E. LeRoy, of the Geological Survey, was also at the meeting.

The committee appointed to deal with a machine gun fund freely subscribed to by miners and others resident at Phoenix, in the Boundary district of British Columbia, includes Mr. P. B. Freeland, one of the Granby Consolidated Co.'s mining engineers, and Mr. John McLaughlin, foreman at the company's big copper mines at Phoenix.

The Standard Silver-Lead Mining Co., operating the Standard mine and concentrating mill near Silverton, Slocan Lake, B.C., has resumed dividend payment, having declared a dividend of 2½ cents a share, total $50,000, on the 2,000,000 issued shares of the company. No dividend was paid by the company during eleven months following September, 1914. Messrs. Henry White, of Wallace, Idaho, and John F. Clark, Spokane, Washington, have been elected directors of the company in place of Messrs. John A. Finch and Patrick Clark, both of Spokane, who died several months ago.

Mr. P. H. Clark, of Spokane, is directing the further development of the Galena Farm mine, near Silverton, Slocan, B.C., which property was bonded by the late Mr. Patrick Clark several months prior to his death.

Messrs. Roy H. Clark and H. Johns, of Spokane, were at Nelson, B.C., in August, in connection with mining operations in that division.

The committee on arrangements for the meeting of the American Institute of Mining Engineers, to be held in San Francisco, California, on September 16-18, consists of Messrs. Charles W. Merrill (chairman), Edward H. Benjamin, Fred. W. Bradley, Abbott A. Hanks, H. C. Hoover and W. C. Ralston.

MOLYBDENUM.

Molybdenum ores, owing to the war, have recently been much more in demand than formerly and enquiries concerning the deposits and the market are frequent. The consumption of molybdenum, under ordinary conditions, is small and the market irregular. Consequently little molybdenum mining has been carried on either in Canada or the United States. Where it has been undertaken, great difficulty has been experienced in concentrating the ores.

The chief, and almost only, source of molybdenum is the mineral molybdenite, a sulphide having the composition MoS_2. This is a soft mineral of bluish black color closely resembling graphite. It commonly occurs in flakes and platy crystals in coarsely crystalline rocks. In breaking the rock to free the flakes the latter are also broken and a considerable part is lost in treatment.

The chief use of molybdenum is in the manufacture of steels, as a hardening agent. Certain salts, such as ammonium molybdite and molybdic acid are used in chemical laboratories, the former being much in use in the determination of phosphorus.

Ordinarily molybdenum ore is quoted at so much per unit. Ores containing over 85 per cent. MoS_2, and free from copper, arsenic, bismuth and tungsten ordinarily sell at about $10 per unit of MoS_2. During the war the price has been three or four times the normal, selling at over $2,000 per ton. No regular quotations are available as the price varies greatly from time to time; the offering of a few tons being sufficient to make a serious change. The principal purchasers in the United States are: The Electrometallurgical Co. of America, New York; Primos Chemical Co., Primos, Pa.; De Gobia and Atkins, San Francisco, Cal.

Molybdenite occurs at several localities in Canada, and the Mines Branch, Ottawa, has published a report on "Molybdenum Ores of Canada," by Dr. T. L. Walker, of Toronto University. Dr. Walker says:

"The chief use to which most of the world's molybdenum is devoted is the preparation of special varieties of steel. . . . . Molybdenum steel is used for rifle barrels, propellor shafts, large guns, wire, and particularly for the manufacture of high speed tools. Molybdenum high speed steel contains from 8 to 10 per cent. molybdenum. When the other elements exist in the right proportion, a steel is obtained of great hardness, with the peculiar property of retaining its temper when heated to a high degree, differing in this respect from all carbon steels. Owing to this property, it is possible to take extremely heavy cuts at high speed, the tool often being heated through this hard use to a dull red heat without impairing its usefulness."

Most of the known occurrences are described by Dr. Walker who selects the following list as representing the most promising deposits as they were to be seen in 1909 and 1910: island opposite Romaine, lower St. Lawrence; Aldfield and Egan townships, north of the Ottawa river, deposits in the vicinity of Kewagama lake in the northern part of Pontiac county, Que., near the Grand Trunk Pacific railway; Brougham, Lyndoch and Ross townships in Renfrew county, Sheffield township, Addington county, and Cardiff township, Haliburton county, in Eastern Ontario; and the Giant mine, Rossland, B.C.

Deposits of molybdenite are known in Northern Quebec on Lake Kewagama in La Motte and La Corne townships. These were described in the reports on Mining Operations in the Province of Quebec for 1911 and 1912. The great difficulty encountered in the exploitation of these deposits has been the problem of concentration, as the molybdenite is found disseminated throughout the rock in a very irregular manner. Several other occurrences, at Manicouagan, at Olomanoshibo, both on the north shore of the Gulf of St. Lawrence; in Egan, Alleyn, Aldfield townships; on Calumet Island, are described in the report by Dr. T. L. Walker.

A NEW BANK AND RAILWAY MAP.

A striking illustration of the financial progress throughout the two older provinces of the Dominion during recent years, with respect to banking facilities, is graphically shown in a new edition of a Bank Map of Ontario and Quebec which has recently been issued by the Department of the Interior at Ottawa. According to the information which has been incorporated in the publication, the number of branches in operation in 1901, the first year for which statistics of this nature are given, totaled approximately 500, in comparison with 2,000 at the present time. This interesting compilation of current banking information is valuable also as a railway map, showing as it does the location, on the various main and branch lines, of all towns and cities. This, together with other general information, makes the publication very useful for reference purposes.

A copy may be procured free of charge upon application to F. C. C. Lynch, superintendent of the Railway Lands Branch, Department of the Interior, Ottawa.

SPECIAL CORRESPONDENCE

PORCUPINE, KIRKLAND LAKE, MUNRO AND KOWKASH

Kowkash—The interest in the new gold districts of Northern Ontario is dwarfing everything else. At this time of writing the discovery at or near Kowkash station on the Transcontinental has developed a regular stampede of the type that prevailed when Cobalt was a new name. Prospectors who have been running drills or attending tables for the past two years; prospectors who have been farming; prospectors who have returned to the city, have thrown up everything to again take the trail on the Transcontinental. So poor were many of the prospectors that without a grubstake they were unable to obtain the modest expenses required to reach a new camp, but interest has been so tense that it has not been difficult to obtain grubstakes. The new discovery is so favorable to everyone that some available information is to be obtained even as early as this, only one week after the stampede began. The National will take any one from Toronto and will land them at Kowkash station at two o'clock in the morning, but one day and one night after they have left the city. The point of interest is 297 miles west of Cochrane, immediately north of the centre of Lake Superior, and not more than 100 miles from the heart of the Michigan Copper district. From Johnson creek or Kowkash station, two points at which prospectors are entering, it is 14 miles and 20 miles respectively to the Dodds discovery.

At this time of writing the discovery is remarkable rather for the fact that it has been made in an entirely new country of favorable formation than anything else. It is stated that at this time, September 7th, the vein stripped is only two to eight wide and not more than twenty feet long. It is phenomenally rich. The country rock is quartz porphyry and schist, and there appears to be quite an area of it.

There are several hundred prospectors in the bush and a very large number of claims have been staked and recorded. It is reasonable to expect that a large amount of work will be done before the snow falls. To date there is practically no work done except on the vein itself, where the bush is burned. Prospectors are coming from all quarters east from Haileybury, from Cobalt, from Porcupine, from Cochrane, up the Algoma Central from the Sault and west from Winnipeg. There is a wild scramble for claims and the discovery clause is disregarded absolutely.

Munro. The remarkable ore being obtained from the shaft on the Dobie by the Dominion Reduction Co. is still attracting much attention. It is an old field, however, and long discredited, and it is difficult for those who have put money into this section to believe that anything can come out of it; however, in spite of the remarkable showing on the Dobie there is not more than a handful of prospectors running in and out of Matheson into the townships tributary to the town. The first gold discovery to be made in Munro township was made in the fall of 1907 by prospectors coming into the Abitibi district following the discovery of gold there. The country was staked wild, and wild catting was abundant. Two years ago remarkable discoveries were made on claims owned by Mr. Dobie and Dr. Taylor of Cobalt, but so thoroughly was the district discredited, that it was not until the past few months that any company could be induced to accept the terms asked by the owners. In regard to the Dobie this demanded a $5,000 cash payment, and this was the stumbling block. Now that the Dominion Reduction has taken it over a shaft has been sunk on the vein at an angle of twenty degrees for 110 feet. It is declared, unofficially, though on good authority, that out of the shaft there has already been taken approximately $150,000.

The vein is from 18 in. to 3 ft. wide, and in addition to the dazzling ore, a sample of which was on exhibition in Toronto, the quartz and basalt is impregnated with fine sulphides. Free gold is often associated with these sulphides and they run well. The presence of telluride ore has also been detected, but it is not known yet what mineral it is. From the shaft 750 lb. of the highest grade ore was hand picked and sent to the Dominion Reduction plant at Cobalt. This ore was again broken up, as well as its extraordinary mineral contents would allow, and jigged. By this means the 750 lb. parcel was reduced to 225 lb.; one quarter of which was gold. It was melted down into two bricks worth approximately $50,000 and shipped to New York.

To-day the station is being cut at 110 ft. and drifting on the vein will commence both ways. Several other people of standing have determined to attempt more development in the vicinity of the Dobie. Mr. A. J. Young and his associates have taken up a veteran claim, and already a small gang of men are at work prospecting. Mr. Chas. Miller of Toronto has been in to see the shaft on the Dobie, and he is determined to start work on a claim which has belonged to him for five or six years past. Two daily stages run from Matheson to Munro and the road is not very difficult.

Tough-Oakes—Owing to the release of about 2 ft. of water stored at the dam of the Charlton Power Co., the Tough-Oakes mine has been closed down for six weeks or two months. The Tough-Oakes has grown so rapidly that the power plant at Charlton was loaded to capacity to run the plant. Now that this 2 ft. of water has been released, it is impossible to run both mill and mine. It was determined, therefore, to run the mill and clean up all ore in sight and shut down the mine. The dumps will be cleaned up and any ore that can be taken from the surface without much difficulty will be run. More than half the force at work have been allowed to go. In the meantime another steam compressor has been ordered, and when this is installed 3,000 ft. of air will be available. This will run the mine and electric power will be used to run the mill only. Development [illegible] satisfactory. The [illegible] across 5 ft. of the winze from the 300 to the 400 ft. level. Both the number three and number six veins have been good and show fine ore.

Goodfish Lake. In the Goodfish Lake section of the Kirkland Lake camp the Dominion Reduction Co. of Cobalt has taken up a group of claims [illegible] 400 acres. Some of these claims adjoining the Castelin and near the Gibson have been obtained on easy terms, and the intention of the company is to prospect them with a view of [illegible] there are any veins [illegible] importance in the district.

Teck Hughes. Mr. A. L. Dennis and associates have purchased outright the control of the Teck-Hughes Mining Co. in Kirkland Lake. They have already started to lay the foundation for the mill and

for a power plant. The mill will be 100 tons and the power plant of sufficient capacity to take care of the requirements of the mine for some time to come.

Prospecting at Porcupine.—In Porcupine interest in many prospects in the camp is steadily growing. This is the result of the remarkable development of the dividend paying mines, particularly the Dome. Upon the Preston East Dome a drill has been placed and a series of holes will be put down. The company has about $9,000 in its treasury and this will be sufficient to pay for the work. If the results obtained are satisfactory, no doubt the reorganization of the company will follow. On the North Dome the Temiskaming Mining Co., who now owns this property outright, has placed a diamond drill, and several holes have been put down to 1,000 ft. Until this is finished no underground work will be commenced.

Rea.—The New Rea Mining Co., which has absorbed the old Rea Consolidated Gold Mines, had determined to sink a shaft on the vein with diamond drill. This vein on the surface is much broken, but very rich. Four drill holes were put down on it. All four cut the orebody; two of them at 175 ft. and two at 263 ft. These four holes showed a vein of promising width and grade. Before closing down the Rea workings the Mines Leasing and Prospecting Co. took out $230,000 from the old orebody.

Mills and Stamps.—An interesting contest has been staged at the Dome and Hollinger mines between the Hardinge Conical mills and stamps. Mr. Hardinge claims that both in regard to costs and tonnage treated, his mills are much better than stamps for the Porcupine ore. At his expense an 8 ft. Hardinge mill has been installed both at the Dome and the Hollinger. They have been placed along side the stamps and will work under parallel conditions. As there has always been a good deal of controversy as to the respective merits of ball mills and stamps in the camp the experiment will be watched with much interest.

COBALT AND GOWGANDA

Upon the conglomerate north of the centre of the town of Cobalt it has been decided to employ Mr. A. R. Whitman to endeavor to establish some facts in regard to the very complicated faulting. Mr. Whitman, who made a name for himself in Porcupine at the McIntyre, will work on the Chambers Ferland, the La Rose, the Nipissing and the Mining Corporation of Canada. He will devote most of his time to an examination on the surface before the snow comes and will afterwards go underground to check up results. As this section of the silver camp is looked upon as the most promising of the unproductive section of the district, the progress of the work undertaken by Mr. Whitman will be followed with a great deal of interest.

The Crown Reserve Mining Co. has passed its dividend and operations have been restricted very considerably. Mr. S. W. Cohen, who is manager, has gone to California to examine a prospect upon which the Crown Reserve Mining Co. has an option.

In the past week silver has risen to over 48 cents, but there is no general confidence that this price will be maintained, low as it is. The market seems to be so fluctuating and uncertain that the mining companies are prone to curtail operations as much as possible.

BRITISH COLUMBIA

Brief mention was made editorially in the Canadian Mining Journal of August 15 of unofficial reports sent out from Ottawa relative to the proposed establishment of copper and zinc refineries in Canada, and Trail, B.C., was mentioned in this connection. Various statements have been made in British Columbia newspapers in connection with the advocacy of certain places as suitable for the location of such works, but there does not yet appear to be good grounds for concluding that there is a reasonable probability of the refining of zinc or copper being undertaken on a commercial scale anywhere else in British Columbia than at Trail, at least not for some time to come. Announcement has also been made that the Federal Government has passed on order-in-Council providing for the payment of a bounty on refined zinc produced in Canada from Canadian ores, such payment to be commenced after the close of the European war and to be continued under certain specified conditions until August 1, 1917. Further reference will be made later to this matter, when more information shall be available; meanwhile it may be noted that it appears to be unlikely that much bounty will be earned in British Columbia; if any, then only during a few months.

West Kootenay.

Slocan. — With the resumption of ore shipping to Trail by the Standard Silver-Lead Mining Co., there has been a marked increase in the quantity of Slocan silver-lead ore received at the Consolidated Mining and Smelting Co.'s works. During 26 weeks of the current year, ended July 1, the total of receipts was 2,385 tons, an average of about 92 tons a week; for the eight weeks following, ended August 26, the total was 3,913 tons, an average of about 489 tons a week. This leaves out of account some silver-lead concentrate shipped to the United States and all the zinc ore and concentrate, also shipped to that country.

The Ivanhoe concentrating mill at Sandon was destroyed by fire on August 30, with an estimated loss of approximately $50,000. The mill was being operated under lease by Mr. J. P. Keane and associates as a custom concentrator, and had for some time been treating ore from the Surprise mine, near Cody, making both silver-lead and silver-zinc concentrates, which products were being shipped to the United States. Quite recently a commencement had been made to also concentrate lead-zinc ore from the Lucky Jime mine at which production was resumed in July after a lengthy suspension of operations. It is announced that arrangements are being made for treating elsewhere the ores from those mines. The Ivanhoe mine and mill were owned and operated ten to twelve years ago by the Minnesota Silver Co., with between 60 and 70 men employed, but for some years both had been inoperative until last year, when different lessees did work at mine and mill respectively. The mill equipment comprised Blake crusher, Robins picking belt, rolls, trommels, one 3 and six 4-compartment jigs, eight Wilfley tables, etc.; its treatment capacity was 65 to 70 tons a day of 12 hours and its products when running on Ivanhoe ore about 7½ tons of silver-lead and 3 tons of zinc concentrates a day.

Other concentrating mills near Sandon are those of the Ruth-Hope and Slocan Star Companies. The former has lately been overhauled and announcement was made recently that it would be operating by the end of August; the Slocan Star mill has been running

throughout the summer after having been closed from the time of the commencement of the European war. At one time there was a concentrating plant, capable of treating 200 tons of ore in 24 hours, in connection with the Payne mine, also near Sandon; another one at the Whitewater mine, within ten miles of Sandon; and still another in connection with the Province Montezuma mines, 10 or 12 miles from Kaslo, but all three were burned at different times. The Rambler-Cariboo Co.'s mill, three miles from Three Forks, up the middle fork of Carpenter creek, is being operated and is making two products, namely, silver-lead and silver-zinc concentrates. At Cody, about two miles south of Sandon, the Noble Five Co. has a concentrating mill, but it has been unused for a long time. It is not unlikely, though, that when a sufficient supply of ore shall have been opened by development work now in progress at the Noble Five group of mines this plant will again be operated. Between Three Forks and Slocan lake, in the western part of Slocan district, there are two unused mills—the old Alamo plant, not likely to be operated again, and a comparatively modern plant near Roseberry that has not yet done much, if any, concentrating work. Near Silverton, Slocan lake, the Standard Co.'s mill, and that of the Silverton Mines, Ltd., known as the Hewitt mill, and situated several mines from the lake up Four-mile creek, are both modern and both make a high percentage saving of the marketable contents of the ores they treat. The Van-Roi mill, still higher up the creek, is also a comparatively new mill, but it has been idle for more than a year. The Enterprise mill, on Ten-mile creek, Slocan City mining division, has not been operated in recent years. In addition to the foregoing, there are several concentrating plants in Ainsworth mining division, in the eastern part of what is comprehensively known as the Slocan district, but at present only two are being operated, namely, that of the Cork-Province, on the south fork of Kaslo creek, and the Highland mill, near Ainsworth. The Bluebell mill is at Riondel, across Kootenay lake from Ainsworth; this plant was closed in August, 1914, when the war demoralized the market for lead, but if not already running is expected to be in operation again shortly.

Trail Creek Division.—Ore receipts at the Consolidated Mining and Smelting Co.'s smeltery at Trail are being well maintained, the average weekly total for eight weeks of July and August having been 8,653 tons as compared with an average of 8,370 tons a week for the half year to July 1. The total for 34 weeks ended August 26 was 286,850 tons, an average of 8,437 tons a week. This compares with a total of 248,043 tons and an average of 7,295 tons a week for the corresponding period of 1914. The proportion from Rossland mines was 222,109 tons, or 6,553 tons a week this year, against 172,111 tons, or 5,062 tons a week during 34 weeks of 1914. It is noteworthy that the mines of the Consolidated Co. produced by far the greater part of the ore shipped from Rossland mines this year, the output of the company's Centre Star group during the period under notice having been 122,854 tons and of the Le Roi 87,745 tons, together 210,599 tons. All but 5 tons of the remaining 11,510 tons was from the Josie group of the Le Roi No. 2, Ltd.

The report of the Josie mine for the month of June, received in London from the company's managers at Rossland, was issued by the Le Roi No. 2, Ltd., at the end of July, and in the course reached British Columbia. It was as follows: Shipped to Trail in June, 1,770 tons of ore and 92 tons of concentrate. Receipts from the smeltery were $21,154 in payment for 1,360 tons of ore shipped and $721 for 57 tons of concentrate; sundry receipts were $757; total receipts for June, $22,632. Estimated working costs for the month were for ore production $7,500 and milling $500; outlay on development was $4,500 and for powder (purchased but unused) $4,968; total expenditure, $17,468. Published figures for April and May were as follows: April, total receipts $22,216, expenditure $12,631; May, receipts $23,865, expenditure $11,050. The receipts for three months, April-June, totaled $68,713 and the expenditure $41,149, leaving a balance of receipts over expenditure in British Columbia of $27,564.

Boundary.

After having been operated for nearly three years with little intermission, the Jewel gold mine and 15 stamp mill, situated near Long lake, eight miles from Greenwood, have been temporarily closed so far as production is concerned, though it is probable a few men will be kept on, doing development work in the mine. The general manager for the Jewel-Denero Mines, Ltd., Mr. Chas. A. Banks, hopes to shortly have work resumed in a small way in the Idaho-Alamo mines, in Slocan district, in which case he will divide his time between directing the further development of that group and the work on the Jewel.

The Greenwood "Ledge" states that about 300,000 lb. of copper is being shipped monthly from the British Columbia Copper Co.'s smeltery at Greenwood. It is estimated that between 20,000 and 25,000 tons of ore a month is being smelted at the works, at which the present ore supply is stated to be sufficient only to keep one 750 ton blast furnace running. The same newspaper recently published the information that Archie Aberdeen, 86 years of age, had gone to work at the B. C. Copper Co.'s Mother Lode mine, near Greenwood, and the suggestion was made that probably Mr. Aberdeen is the oldest miner working in Canada.

Yale.

While the mineral production of this district continues to be unimportant in comparison with that of the Kootenay and Boundary districts, there is a little mining being done in it and a number of prospectors are giving their attention to mineral locations in various parts of the large area included within its boundaries. Early in the year a trial shipment of 8 tons of ore was made to the smeltery at Trail from the Rainbow, in the Hope section of the district; a few weeks ago 21 tons was shipped to Trail from the Copper King group, Coutlee, in the Nicola section; ore receipts at Trail from the Iron Mask, near Kamloops, during June and July, totaled 405 tons. Other claims have been or are being prospected this year, in some instances with encouraging results. In this connection it may be mentioned that the Hope Review recently published some particulars of work in progress on a group of claims on which it was claimed there has been opened a gold-bearing quartz vein from 12 to 18 in. wide. This vein is stated to have been traced for more than 3,000 ft. on the west side of Coquihalla river, near Kodiak creek, at an elevation of 2,000 ft. A tunnel 60 ft. has been driven and near by a log cabin has been erected. The group comprises 20 mineral claims, and others have been staked in the neighborhood by other men attracted by the samples of gold ore obtained.

NEWFOUNDLAND

Never before in the history of Newfoundland was there such general prosperity in mining matters as prevails at present. Every mine throughout the country is working full time, with full complements of men, and in most cases working day and night.

The output of hematite iron ore from the Wabana mines, owned by the Dominion Iron and Steel Co. and the Nova Scotia Steel Co., has increased from week to week since the early spring days, and now exceeds 100,000 tons weekly. During one day last week no less than six steamers arrived at the different ore piers of Wabana for ore cargoes, and were given ready and quick despatch. Apart from the large quantity of this ore which finds its way to the smelters at Sydney, C.B., several cargoes are being shipped to Great Britain. Only one cargo has been destroyed by German submarines.

Activity in the copper mines is equally great; although the shipments are not so large. All of the old copper dumps which have lain around some of the mines which have been worked out or shut down for years, have been gathered up, and shipped to the smelters of Pittsburg, New York and other American cities. As a result of the great boom in copper, several prospecting companies have gone out during the past season, and reports are reaching the Department of Agriculture and Mines weekly of valuable discoveries being made in copper and other minerals. In the early days of copper mining in this country—some thirty to forty years past—much of the ore taken from the mines of Tilt Cove, Bett's Cove and Little Bay was smelted locally; but owing to the crude machinery employed and the resultant waste that occurred, the work of smelting was abandoned, and the ore was shipped to Swansea in a green state.

Now, however, I am pleased to state Newfoundland is shortly to have an up-to-date electric smelter established in one of the central districts. The work which will mean so much to the copper industry of the country is being undertaken by Mr. Wm. McKay, a Newfoundlander by birth, but who has had many years of very successful experience in the coal and other mining and smelting interests of Sydney, C.B.

Apparently what will give additional impetus to the great mining activity now going on throughout the Colony is the establishment of shell factories within the country. The first will commence operation shortly, with a capacity of one thousand shells weekly. This is to be followed by others in due time.

The first cargo of manganese ore to be shipped abroad for some time leaves the workings of Brigus, Conception Bay, for Pittsburg within a few days. For some time the authorities debarred the shipment until satisfactorily assured by the owners and buyers that the same was not to be utilized for the use or aid of the enemy.

Since the advent of the great European war, many enquiries have been made to the Mines Department and to private parties from some of the large iron ore corporations of the United States as to the quality and probable extent of the manganese deposits of Newfoundland. As a consequence of these enquiries, we hear from time to time of new discoveries of this ore being brought to light; but as yet the practical eye of the mining engineer and the searchlight of the assayist has to be brought to bear upon these new finds.

Many enquiries have also been received lately, both from England and the United States, for deposits of magnesite and antimony within the Colony. Both ores are known to exist here, but as to what extent has never been determined.

NEW YORK

Relative to the extraordinary increase in the export of American manufactured goods, the Secretary of Commerce at Washington has commenced sending out a series of circulars to thousands of business men, at a cost of five cents per week. These circulars give a daily survey of world trade opportunities as reported by over 300 consular agents. Such a source of information and foreign point-of-view is sorely needed, if American business men are to hold any considerable export trade in manufactures.

Aluminum is finding increased uses constantly. For automobile parts, and all light vehicle or hand utensils, its advantages are undeniable. The recent strike in the big smelting plant at Massena, N.Y., just across the Canadian border, was settled by granting small increases in pay to the men. Aluminum prices have advanced to 40-45 cents per lb.

Utah Copper, Chino, Ray Consolidated and Nevada Consolidated, the four big "porphyry" coppers, had a combined output for July of 22,000,000 lb. of copper, which about equals Anaconda's output for the same month, but is somewhat under the output of the Lake Superior district.

The New Jersey Zinc Co., generally credited with being the largest spelter producer in the word, has been making large profits, because of its control of particularly high-grade zinc from the Franklin furnace, New Jersey, fields, which are within 50 miles of New York City. No lead occurs mixed with these New Jersey ores. Besides its holdings in the East, this company operates custom zinc smelters throughout the Middle West.

During this period of readjustment to war conditions, many American financiers are showing unusual interest in Canadian conditions, and are disposed to buy Canadian issues in cases where prices are depressed.

President Earling of Chicago, Milwaukee and St. Paul Railway, which controls a line of railway from Chicago through the North West to the Pacific Coast, has announced that the Panama Canal cost the road $1,000,000 in gross revenues in the last fiscal year. Reduction was mostly in west bound commodities.

Calumet and Hecla's dividend No. 173 of $15 per share recently declared makes a total so far this year of $35, compared to $10 in 1914, $32 in 1913, $42 in 1912, $24 in 1911, $29 in 1910, $27 in 1909, $20 in 1908, $65 in 1907, $70 in 1906. The high figure is $100 in 1899.

Anaconda, the premier copper producer, is aiming at an eventual output of the enormous quantity of 300,000,000 lb. per year.

The German Government is paying its citizens 43.3 cents per lb. for copper pots, pans and boilers, and 33 cents per lb. for brass articles.

The improvement in Porcupine conditions at depth is much liked, and curiosity exists as to the outcome of the new Canadian electric zinc smelter at Welland, Ontario. Relative to the mining of zinc ore in Quebec, it is pointed out that important high grade zinc ores have long been mined in the Appalachians in western New Jersey, while a rich zinc mine is now successfully operating in northern New York, only 30 miles from the Canadian border.

METAL PRODUCTION IN CALIFORNIA IN 1914.

The total yield of mine gold in California in 1914, as reported by Charles G. Yale, of the United States Geological Survey, was $20,653,496, an increase of $246,538 over that of 1913. With the exception of one year—1883—the mine gold output of the State in 1914 was higher than it has been since 1864, 50 years ago.

The value of the entire mine output of gold, silver, copper, lead and zinc in California in 1914 was $25,710,645, which is $1,101,842 less than the value in 1913. The decrease is mainly due to the falling off of the production of copper brought about by the closing down of certain large properties soon after the outbreak of the war. Since the close of the year, however, these plants have resumed operations. There was an increase in the output of silver of 93,460 oz., and of lead of 737,581 lbs., but the output of zinc declined.

In 1914 there were 658 properties reporting production, of which 318 were deep mines and 340 placers. The producing deep mines may be classified by metal product as follows: Gold, 277; copper, 19; silver, 7; silver-lead, 6; and lead, 9. Of the placer mines 105 were hydraulic, 60 dredges, 70 drift, and 105 sluicing or surface placer mines.

In 1914 there was treated in gold and silver mills in California 1,993,821 tons of ore, containing altogether $10,743,207 in gold, an average value of $5.39 per ton, and $91,327 in silver, an average value of $0.05 per ton. This gives a total value of $10,834,534 in gold and silver, or an average per ton of $5.44 in both metals. In milling the 1,993,821 tons of ore there was recovered as bullion $8,637,329 in gold and silver, or $4.33 per ton, and from this ore was derived 46,072 tons of concentrates, which yielded in gold and silver $2,197,205, or an average of $47.69 per ton.

The 449,132 tons of smelting ore treated yielded altogether metals valued at $5,633,856, or an average of $12.54 per ton, including all metals. There was treated also 22,532 tons of old tailings, which yielded $83,624 in gold and silver, or an average of $3.71 per ton.

The 340 productive placers in California yielded $9,080,849 in gold and $19,287 in silver, a total of $9,100,136, which is an increase of $242,590 from this source over the yield of 1913. The dredge yield fell off $306,900 in gold, but there was an increase in total output from the hydraulic, drift, and surface placers of $551,572 in gold, or $244,672 more than the decrease in the dredge yield. Of the total placer gold the 60 dredges yielded $7,783,394, or 86 per cent.; the 105 hydraulic mines, $702,884, or 8 per cent.; the 70 drift mines, $329,948, or 3 per cent., and the 105 surface or sluicing mines $264,623, or 3 per cent. The dredges in the State produced 38 per cent. of the total gold yield from all sources. The placers produced 44 per cent. of the total gold yield, for 1914, and the deep mines 56 per cent. These average percentages have changed very slightly for several years past. There are now 60 gold dredges operating in the State, and since the commencement of dredging in California in 1898 the total gold yield from this source to the end of 1914 has been $71,307,766. The three principal dredging fields in the State are at and near Marysville, Yuba County, with a dredge gold yield in 1914 of $2,755,734; at and near Oroville, Butte County, with a yield in 1914 of $1,647,515, and at Folsom, Sacramento County, with a yield in 1914 of $2,161,661. Dredges are also in operation in the Counties of Calaveras, Merced, Placer, Shasta, Siskiyou, Stanislaus and Trinity.

Of the total ore milled in California from deep mines, 1,243,529 tons, or 62 per cent., came from the mines in the five Mother Lode counties of Amador, Calaveras, El Dorado, Mariposa and Tuolumne. This ore yielded, on an average, in gold and silver, $5,075,552, or $4.08 per ton.

The 629,037 tons of ore from Amador County yielded $4.89 per ton, but the 859,509 tons from Calaveras County averaged only $2.32 per ton. The average value per ton in El Dorado County was $4.95; in Mariposa, $9.19, and in Tuolumne, $4.24.

The two largest gold-producing deep-mine camps in the State are Grass Valley (including Nevada City), and Jackson (including Sutter Creek), in Amador County, and it is the productiveness of these two districts that gives Nevada and Amador first and second rank, respectively in the quantity and value of gold produced in 1914. The largest gold producing mines on the Mother Lode are in the Jackson district where the 387,602 tons of ore was treated in 1914, yielding $2,113,098 in gold and $12,674 in silver, an average of $5.48 per ton. In the Grass Valley and Nevada City districts, 267,618 tons of ore was treated, yielding $2,997,405 in gold and $25,868 in silver, an average of $11.30 per ton in gold and silver. The most productive metal camp of the State is at Kennott, Shasta County, where the mines and smelter of the Mammoth Copper Co. are located. From all the mines at and near this place 243,138 tons of ore was treated, yielding $376,846 in gold, $299,110 in silver, and $2,411,323 in copper, a total of $3,087,279, or $12.70 per ton.

COMPOSITION OF NATURAL GASES.

The United States Bureau of Mines has just issued Technical Paper 109, which deals with the chemical and physical properties of the natural gases used in twenty-five cities in the United States. In this paper, which gives the first comparative data of this kind ever published, the authors, G. A. Burrell and G. G. Oberfell, say:

"The composition of the natural gas from twenty-five cities in the United States is shown. Five of the samples contain methane only as the combustible gas. The others contain, in addition to methane, higher members of the series of paraffin hydrocarbons. The heating values range from 735 to 1312 B.t.u. per cu. ft. at 0° C. and 760 mm. pressure.

"Natural gas in two different sands of the same field may vary materially in composition.

"Some of the natural gas used in Texas has a heating value of about 740 B.t.u. per cu. ft. at 0° C. and 760 mm. pressure.

"The natural gas used in Pittsburg, Columbus, Cleveland, Cincinnati and many other places in the East is quite uniform in composition.

"The explosive limits of mixtures of natural gas and air lie between about 5.00 per cent gas, low limit, and 11.50 per cent. gas, high limit.

"For many of the natural gases listed, there is required about 10.0 cu. ft. of air per cu. ft. of gas, for complete combustion.

"There is needed a very large amount of natural gas to suffocate men. As far as small animals (canaries) are concerned, the effect on them of mixtures of natural gas and air is principally due to the lowering of the oxygen-content of the air by the diluting action of the gas.

"The composition of the natural gas used in any one town may remain remarkably uniform for a long period of time.

Copies of this paper may be obtained by applying to the Bureau of Mines, Washington, D.C.

MARKETS

STOCK QUOTATIONS.

(Courtesy of J. P. Bickell & Co., Standard Bank Building, Toronto.)

September 9, 1915.

New York Curb.

	Bid.	Ask.
Alaska Gold	32.00	32.25
British Copper.	.50	1.00
Braden Copper	81.00	81.25
California Oil	303.00	306.00
Chino Copper	45.25	45.50
Giroux Copper	.50	1.00
Goldfield Cons.	1.25	1.37½
Green Cananea	37.00	39.00
Granby	81.50	..
Inspiration Copper	..	..
International Nickel	189.00	191.00
Miami Copper	27.00	27.12½
Nevada Copper	14.62½	14.75
Ohio Oil	154.00	156.00
Ray Cons. Copper	22.25	22.50
Standard Oil of N. Y.	193.00	194.00
Standard Oil of N. J.	443.00	446.00
Standard Oil (old)	1450.00	..
Standard Oil (subs.)	1050.00	..
Tonopah Mining	5.75	6.00
Tonopah Belmont	3.75	4.00
Tonopah Merger	35.00	37.00
Yukon Gold	2.25	2.50

Porcupine Stocks.

	Bid.	Ask.
Apex	.02¾	.02⅞
Dome Extension	.24¼	.24¾
Dome Lake	.23	.24
Dome Mines	21.00	21.50
Foley O'Brien	.28	.30
Hollinger	25.40	26.50
Jupiter	.12¾	.13
McIntyre	.47½	.48
Moneta	..	.07½
Pearl Lake	.00¼	.00⅜
Porcupine Gold	....	.00⅝
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Cobalt Stocks.

	Bid.	Ask.
Bailey	.04	.04⅛
Beaver	.26	.27
Buffalo	.30	.50
Chambers Ferland	.13½	.14
Coniagas	3.85	4.00
Crown Reserve	.34	.34¾
Foster	.01	.03
Gifford	.01½	.01⅝
Gould	.01	.01⅛
Great Northern	.02½	.03
Hargraves	.01	.01½
Hudson Bay	20.00	..
Kerr Lake	3.40	3.55
La Rose	.49	.55
McKinley	.21	.26
Nipissing	5.75	5.80
Peterson Lake	.19¼	.19½
Silver Leaf	.01½	.02
Teck Hughes	.06½	.07
Temiskaming	.33	.33½
Trethewey	.11½	..
Wettlaufer	.05	.09
Seneca Superior	..	.80
York Ontario	.01½	.02

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	New York	London
August—	cents.	pence.
25	46⅞	22⅛
26	46¾	22⅛
27	47⅛	23
28	46⅞	22⅛
30	47	23
31	46⅝	23
September—		
1	46¼	23⅛
2	47¼	23⅛
3	48⅛	23⅜
4	48½	23½
6	Holiday	23½
7	48⅝	23⅝
8	48¼	23⅝
9	48⅝	23⅝

TORONTO MARKETS.

Sept. 9, 1915 (Quotations from Canada Metal Co., Toronto)—
- Spelter, 18 cents per lb.
- Lead, 6½ cents per lb.
- Tin, 40 cents per lb.
- Antimony, 40 cents per lb.
- Copper casting, 19 cents per lb.
- Electrolytic, 19 cents per lb.
- Ingot brass, yellow, 13c.; red, 15c. per lb.

Sept. 9, 1915 (Quotations from Elias Rogers Co., Toronto)—
- Coal, anthracite, $7.75 per ton.
- Coal, bituminous, $5.25 per ton.

NEW YORK MARKETS.

Sept. 9, 1915—Connellsville coke (f.o.b. ovens)—
- Furnace coke, prompt, $1.60 to $1.65 per ton.
- Foundry coke, prompt, $2.30 to $2.60 per ton.
- Tin, straits, 33.12½ cents.
- Copper, Prime Lake, 17.37½ to 17.62½c.
- Electrolytic copper, 17.25 to 17.50c.
- Copper wire, 19.25c.
- Lead, 4.70c.
- Spelter, 14.25 to 14.50c.
- Sheet zinc (f.o.b. smelter), 16.00c.
- Platinum, hard, $44.00 per oz.
- Platinum, soft, $42.00 per oz.
- Quicksilver, $89.00 to $90.00 per 75-lb. flask

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The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

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Most of the older reports are out of print, but they may usually be found in public libraries, libraries of the Canadian Mining Institute, etc.

REPORTS RECENTLY ISSUED:

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Memoir 59. Coal Fields and Coal Resources of Canada, by D. B. Dowling.
Summary Report of the Geological Survey for the year 1914.
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Memoir 20. Gold fields of Nova Scotia, by W. Malcolm.
Memoir 60. Arisaig-Antigonish District, Nova Scotia, by M. Y. Williams.
Memoir 41. The "Fern Ledges" Carboniferous flora of St. John, New Brunswick, by Marie C. Stopes.
QUEBEC
Memoir 64. Preliminary Report on the Clay and Shale Deposits of the Province of Quebec, by J. Keele.
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MAPS RECENTLY ISSUED:

CANADA
Map 91A. Geological map of the Dominion of Canada and Newfoundland. Scale 100 miles to 1 inch
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Map 27A. Bathurst and vicinity, Gloucester County, New Brunswick. Geology.
Map 39A. Geological Map of Nova Scotia.
Map 121A. Franey Mine and Vicinity, Victoria County, N. S.
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Map 95A. Broadback River, Mistassini Territory, Quebec. Geology.
Map 100A. Bell River, Quebec. Geology.
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Map 124A. Wanapitei (Falconbridge, Street, Awrey, and Parts of Maclennan and Scadding Townships), Sudbury District, Ont. Geology.
Map 49A. Orillia sheet, Simcoe and Ontario Counties, Ontario. Topography.
NORTH-WEST PROVINCES
Map 55A. Geological map of Alberta, Saskatchewan and Manitoba
Map 117A. Wood Mountain Coal Area, Saskatchewan.
BRITISH COLUMBIA
Map 33A. Nanaimo sheet, Vancouver Island, British Columbia. Topography.
Map 70A. Victoria sheet, Vancouver Island. Geology.
Map 72A. Saanich sheet, Vancouver Island. Geology.
Map 103A. Prescott, Paxton and Lake Mines, Texada Island. Topography.
YUKON AND NORTH-WEST TERRITORIES
Map 113A. Canadian routes to White River District, Yukon, and to Chisana District, Alaska.

NOTE.—Maps published within the last two years may be had, printed on linen, for field use. A charge of ten cents is made for maps on linen.

The Geological Survey will, under certain limitations, give information and advice upon subjects relating to general and economic geology. Mineral and rock specimens, when accompanied by definite statements of localities, will be examined and their nature reported upon. Letters and samples that are of a Departmental nature, addressed to the Director, may be Mailed O.H.M.S. free of postage.

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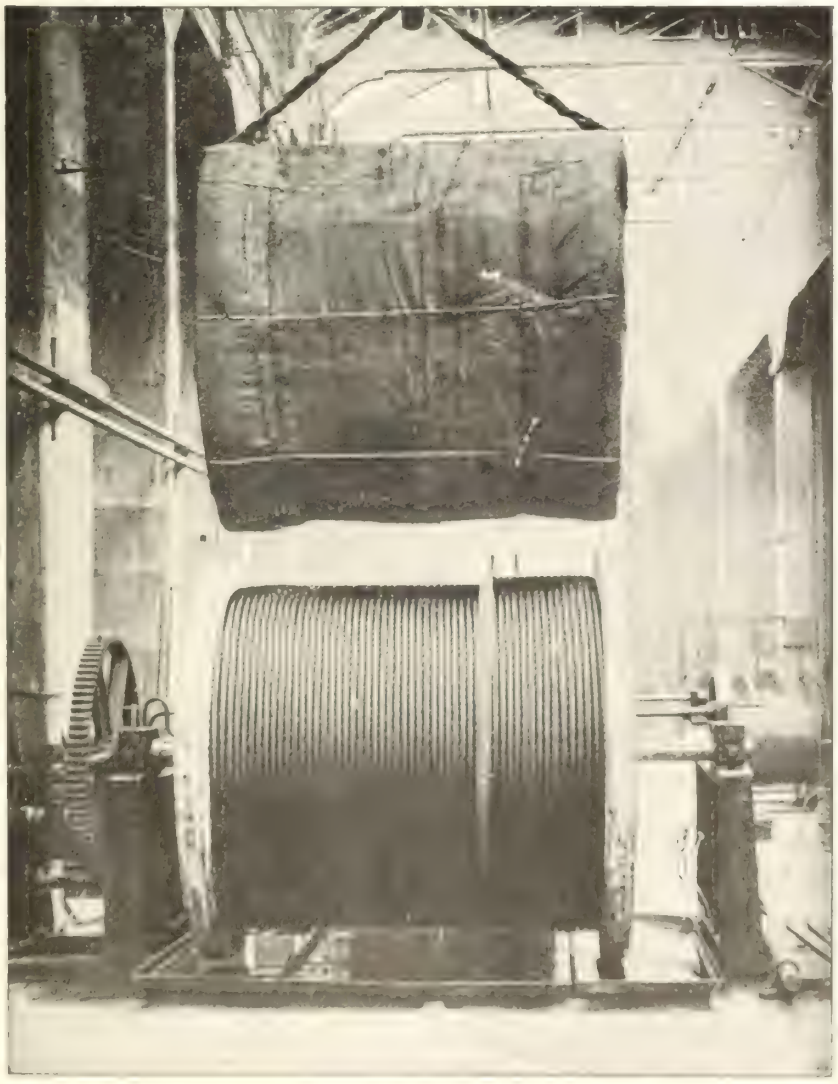

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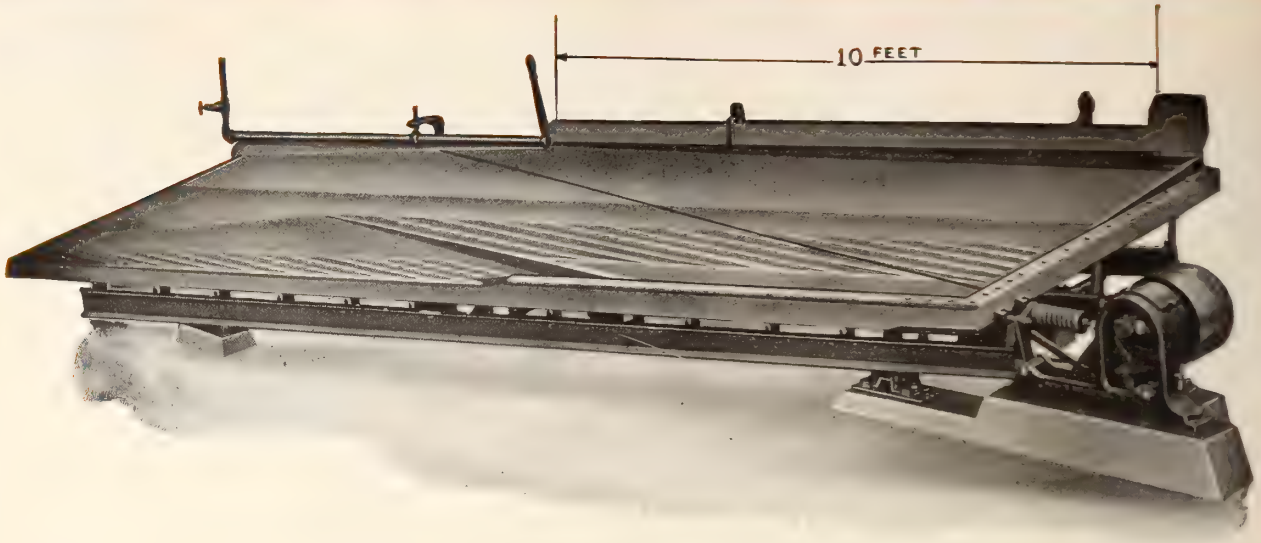

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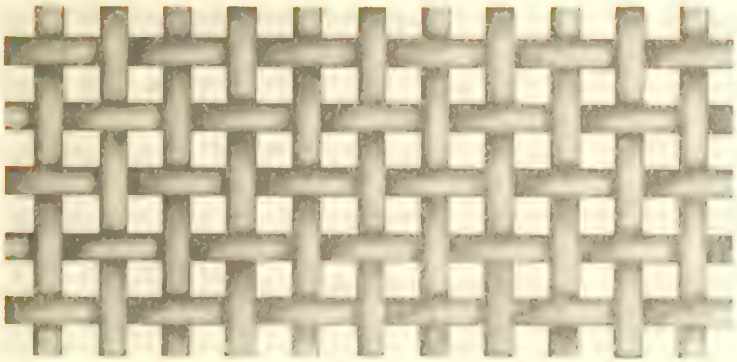

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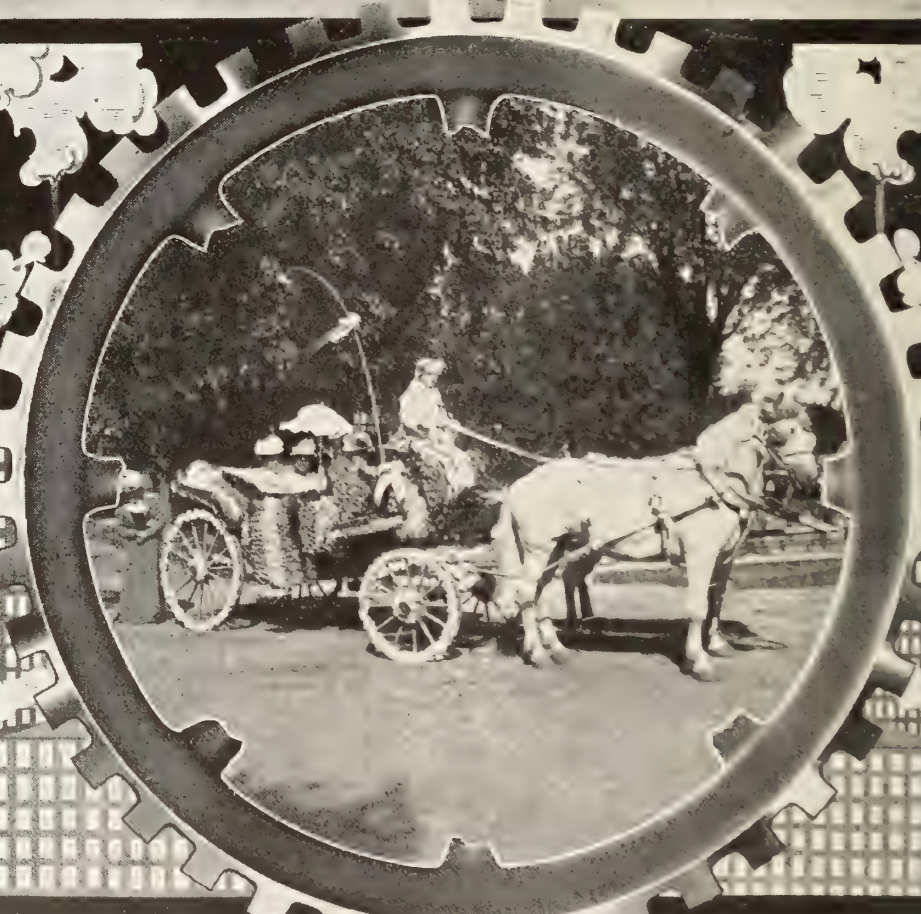

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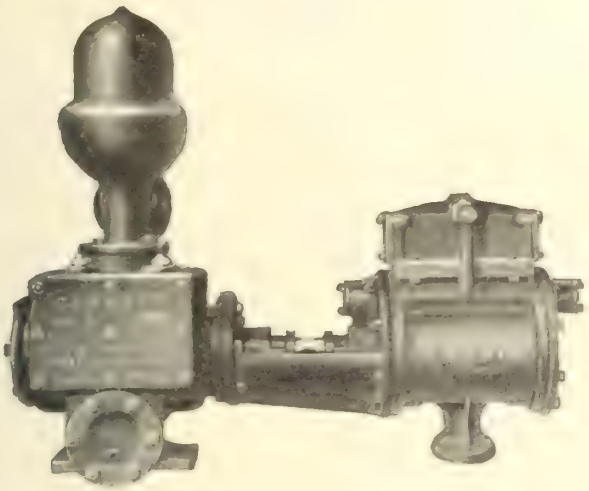

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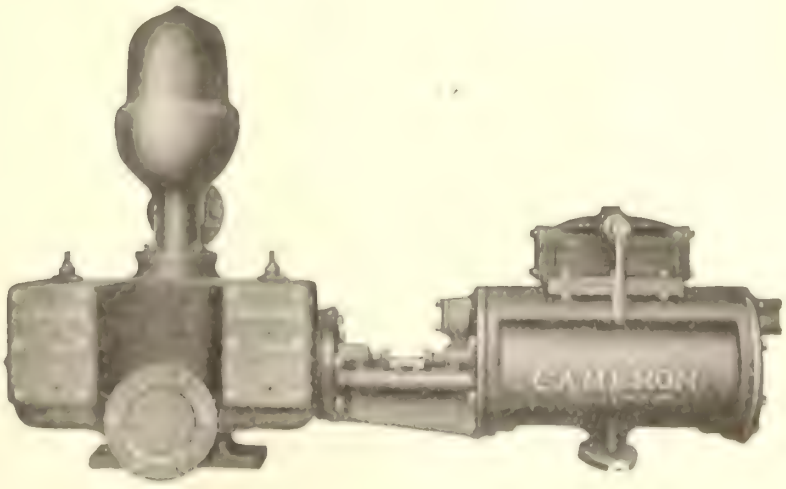

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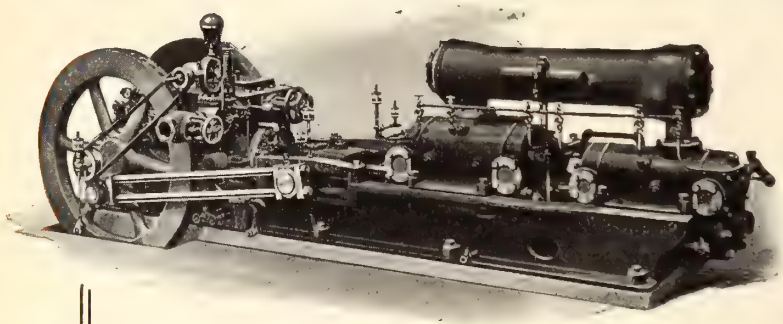

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Sullivan "WB2" Air Compressors

————, Mar. 29, 1915.

"Regarding our Sullivan Compressor WB2, I wish to say that this compressor was installed in 1906, and has been in continuous use ever since. We have run only this one compressor at this mine, and the mine has never been closed down in all that time. * * * We believe that the compressor is in as good condition today as it was at any time since the first year we bought it.

"We have made our plans to install another compressor as soon as the coal business justifies it, and we have determined that the new compressor shall be another WB2, precisely similar to the one we are now using."

(This letter may be seen in our files.)

This is an example of the service that Sullivan Straight Line, Two-Stage, Steam Driven Compressors are furnishing their owners all over the world.

"WB2" Compressors are built in capacities from 300 to 2500 cubic feet of free air per minute.

BULLETIN 658J

SULLIVAN MACHINERY COMPANY 122 S. MICHIGAN AVE. CHICAGO, U.S.A.

The Minerals of Nova Scotia

The extensive area of mineral lands in Nova Scotia offers strong inducement for investment.

The principal minerals are:—Coal, iron, copper, gold, lead, silver, manganese, gypsum, barytes, tungsten, antimony, graphite, arsenic, mineral pigments, diatomaceous earth.

Enormous beds of gypsum of a very pure quality and frequently 100 feet in thickness are situated at the water's edge.

The Province contains numerous districts in which occur various varieties of iron ore practically at tide water and in touch with vast bodies of fluxes.

The Gold Fields of the Province cover an area of approximately 3,500 square miles. The gold is free milling and is from 870 to 970 fine.

Deposits of particularly high grade manganese ore occur at a number of different localities.

Tungsten-bearing ores of good quality have lately been discovered at several places and one mine has recently been opened up.

High-grade cement-making materials have been discovered in favorable situations for shipping.

Fuel is abundant, owing to the presence of 960 square miles of bituminous coal and 7,000,000 acres of woodland.

The available streams of Nova Scotia can supply at least 500,000 H.P., for industrial purposes.

Prospecting and Mining Rights are granted direct from the Crown on very favorable terms.

Copies of the Mining Law, Mines Reports, Maps and Other Literature may be had free upon application to

HON. E. H. ARMSTRONG,
Commissioner of Public Works and Mines,
HALIFAX, N. S.

PROVINCE OF QUEBEC

Department of Colonization, Mines and Fisheries

The chief minerals of the Province of Quebec are Asbestos, Chromite, Copper, Iron, Gold, Molybdenite, Phospate, Mica, Graphite, Ornamental and Building Stone, Clays, etc.

The Mining Law gives absolute security of Title and is very favourable to the Prospector.

MINERS' CERTIFICATES. First of all, obtain a miner's certificate, from the Department in Quebec or from the nearest agent. The price of this certificate is $10.00, and it is valid until the first of January following. This certificate gives the right to prospect on public lands and on private lands, on which the mineral rights belong to the Crown.

The holder of the certificate may stake mining claims to the extent of 200 acres.

WORKING CONDITIONS. During the first six months following the staking of the claim, work on it must be performed to the extent of at least twenty-five days of eight hours.

SIX MONTHS AFTER STAKING. At the expiration of six months from the date of the staking, the prospector, to retain his rights, must take out a mining license.

MINING LICENSE. The mining license may cover 40 to 200 acres in unsurveyed territory. The price of this license is Fifty Cents an acre per year, and a fee of $10.00 on issue. It is valid for one year and is renewable on the same terms, on producing an affidavit that during the year work has been performed to the extent of at least twenty-five days labour on each forty acres.

MINING CONCESSION. Notwithstanding the above, a mining concession may be acquired at any time at the rate of $5 an acre for SUPERIOR METALS, and $3 an acre for INFERIOR MINERALS.

The attention of prospectors is specially called to the territory in the North-Western part of the Province of Quebec, north of the height of land, where important mineralized belts are known to exist.

PROVINCIAL LABORATORY. Special arrangements have been made with POLYTECHNIC SCHOOL of LAVAL UNIVERSITY, 228 ST. DENIS STREET, MONTREAL, for the determination, assays and analysis of minerals at very reduced rates for the benefit of miners and prospectors in the Province of Quebec. The well equipped laboratories of this institution and its trained chemists ensure results of undoubted integrity and reliability.

The Bureau of Mines at Quebec will give all the information desired in connection with the mines and mineral resources of the Province, on application addressed to

THE HONOURABLE THE MINISTER OF COLONIZATION, MINES AND FISHERIES, QUEBEC.

When Answering Advertisements please mention THE CANADIAN MINING JOURNAL.

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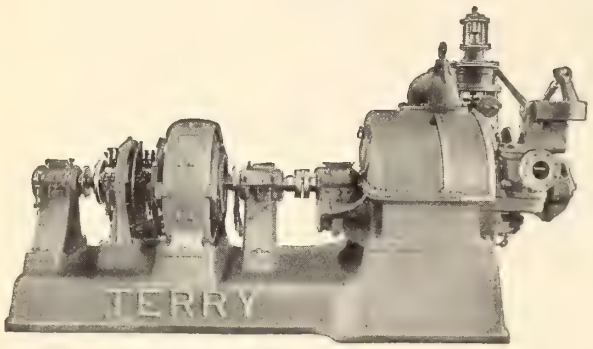

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Find how others are increasing their production and profits and decreasing their expenses.

Terrys are perfect in every respect—absolutely reliable and built for hard continuous running.

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Contains the Chocolate, Milk and Sugar

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Special Prices to Institutions and Camps. Liberal Samples to Physicians and Nurses.

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Our Foundry and Machine Shops are large and modern, send in your specifications for prices.

COMPLETE CATALOGUE ON REQUEST

DODGE MANUFACTURING CO., LTD.

TORONTO MONTREAL

Synopsis of Coal Mining Regulations

COAL mining rights of the Dominion, in Manitoba, Saskatchewan and Alberta, the Yukon Territory, the North-West Territories and in a portion of the Province of British Columbia, may be leased for a term of twenty-one years at an annual rental of $1 an acre. Not more than 2,560 acres will be leased to one applicant.

Application for a lease must be made by the applicant in person to the Agent or Sub-Agent of the district in which the rights applied for are situated.

In surveyed territory the land must be described by sections, or legal sub-divisions of sections, and in unsurveyed territory the tract applied for shall be staked out by the applicant himself.

Each application must be accompanied by a fee of $5 which will be refunded if the rights applied for are not available, but not otherwise. A royalty shall be paid on the merchantable output of the mine at the rate of five cents per ton.

The person operating the mine shall furnish the Agent with sworn returns accounting for the full quantity of merchantable coal mined and pay the royalty thereon. If the coal mining rights are not being operated, such returns should be furnished at least once a year.

The lease will include the coal mining rights only, but the lessee may be permitted to purchase whatever available surface rights may be considered necessary for the working of the mine at the rate of $10.00 an acre.

For full information application should be made to the Secretary of the Department of the Interior, Ottawa, or to any Agent or Sub Agent of Dominion Lands.

W. W. CORY, Deputy Minister of the Interior.

N.B.—Unauthorized publication of this advertisement will not be paid for.

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We wish to draw the attention of mining, metallurgical, and development corporations to our excellent facilities for compiling, arranging, illustrating, printing and distributing Annual Statements, Special Reports, Descriptive Pamphlets, etc.

We guarantee our work in all respects. In letter-press, half-tone engravings and reproductions in colour, we are prepared to give entire satisfaction.

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Sullivan Diamond Drills, Compressors, Rock and Hammer Drills, Hoists, Boilers, Ore Cars, Buckets, Drill Steel, Drill Sharpeners, Shafting, Transmission and Conveying Material.

Hoisting Cable, Screens, Iron Pipe and Fittings, Valves, Building Supplies, Camp and Kitchen Supplies, General Line Light and Heavy Hardware.

We will be pleased to have your specifications and to quote you on your requirements.

"IT WILL PAY YOU TO GET OUR PRICES."

Our Large Stock Guarantees You the Most Prompt Delivery on All Orders.

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COBALT PORCUPINE TIMMINS

Milling and Mining Machinery

Shafting, Pulleys, Gearing, Hangers, Boilers, Engines, and Steam Pumps, Chilled Car Wheels and Car Castings, Brass and Iron Castings of every description, Light and Heavy Forgings.

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A state institution offering engineering courses leading to the degree of Engineer of Mines. Located in the Lake Superior mining district. Mines and mills accessible for college work. For Year Book and booklet of views, address President or Secretary.

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There are many millions of acres in Eastern, Northern, and Northwestern Ontario where the geological formations are favorable for the occurrence of minerals, the pre-Cambrian series being pre-eminently the metal-bearing rocks of America.

The phenomenally rich silver mines of Cobalt occur in these rocks; so also do the far-famed nickel-copper deposits of Sudbury, the gold of Porcupine and Kirkland Lake, and the iron ore of Helen, Magpie, and Moose Mountain. .

Many other varieties of useful minerals are found in Ontario:—cobalt, arsenic, iron pyrites, mica, graphite, corundum, talc, gypsum, salt, petroleum, and natural gas.

Building materials, such as brick, lime, stone, cement, sand and gravel, are abundant.

The output of the mines and metallurgical works of Ontario for the year 1913 was valued at $53,232,311. Ontario has the largest mineral production of any of the Provinces.

The prospector can go almost anywhere in the mineral regions in his canoe; the climate is invigorating and healthy, and there is plenty of wood and good water.

A miner's license costs $5.00 per annum, and entitles the holder to stake out three claims a year in every mining division.

For maps, reports of the Bureau of Mines, and mining laws, apply to

HON. G. H. FERGUSON,
Minister of Lands, Forests and Mines.

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Glace Bay — Nova Scotia

19 Collieries
Output—5,000,000 tons annually

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Screened, run of mine and slack

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Collieries at Glace Bay, C.B., and Springhill, N.S.

Shipping Ports—Sydney and Louisburg, C.B., and Parrsboro, N.S.

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or at the offices of the Company at
171 Lower Water Street, Halifax, N.S.
and to the following Agents
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Buntain, Bell & Co., Charlottetown, P.E.I.
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For Calendar of the School and further information apply to The Secretary, School of Mining, Kingston, Ontario.

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Two sizes:
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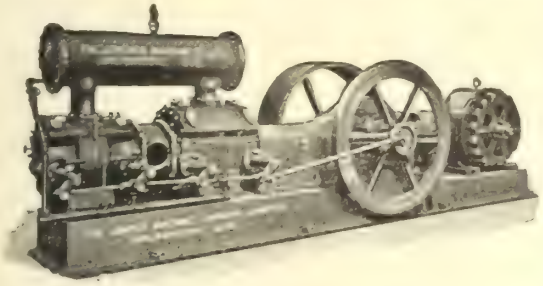
We are Sole Refiners of this natural, stronger than steel, non-corrosible alloy. Produced as rods, flats, castings, tubes, sheets, strip stock and wire.

AIR COMPRESSORS

¶ Do you know how much air your compressor is furnishing?

¶ Most compressors are rated too high, many sources of loss of power being ignored.

¶ If you wish to obtain a definite quantity of compressed air at the least cost for power and maintenance, use a JENCKES compressor.



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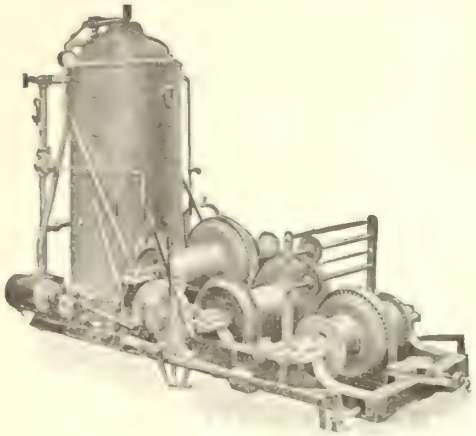

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Leading to ACADEMIC and PROFESSIONAL Degrees

For Calendar and other information apply to the Secretary.

A. T. LAING.

PRACTICAL DOMINION ENCYCLOPAEDIA

The Cathedral at Rheims was ruthlessly destroyed by the Germans in 1914 ; this is not news to the average Canadian,—

BUT——

Can you pronounce Rheims properly?
How far is it from Paris? Is it nearer to Paris than London is to Toronto?
In what kind of country is it located?
For what is it important?
When was the Cathedral built?
Of what style of Architecture?

DO YOU KNOW?

"It (Rheims) has been the seat of an Archbishorpic since the 8th century and was made the place of Coronation in 1170, when Philip Augustus was crowned here.

Rheims is famous as the place where Clovis was baptized in 496, for the crowning of the dauphin in the presence of Joan of Arc, and for the fact that all the French Kings were crowned here down to 1825, except Henry IV, Napoleon, and Louis XIII.

The above quotation is an extract from the article on Rheims in the

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Never before was an encyclopædia so essential as at the present.

The attention of all Canadians now is directed to Countries, Cities, Churches, Rivers and Mountain Passes, where Armies of the highest type of Civilization, for more than a year have met in almost daily combat, and of the final outcome, no man now hazards a definite prophesy.

Who would confess to an apathy in regard to these places? No book or guide serves the purpose of investigation so well as an encyclopaedia.

The "PRACTICAL DOMINION ENCYCLOPAEDIA" is now available to the readers of the Mining Journal at a nominal price.

"PRACTICAL DOMINION ENCYCLOPAEDIA"—A universal reference library in the Arts, Sciences and Literature. Nearly one thousand Illustrations, Half-tone Engravings, Etchings, Drawings, Plans and Maps embelish this work, which is a feature of great utility.

No labour or expense has been spared in the production of this Work of Reference. It is printed on thin paper, so that the volume has been very much reduced in size. Nearly three thousand pages of sujects of interest and importance, up to date, in three volumes prepaid for $12.00.

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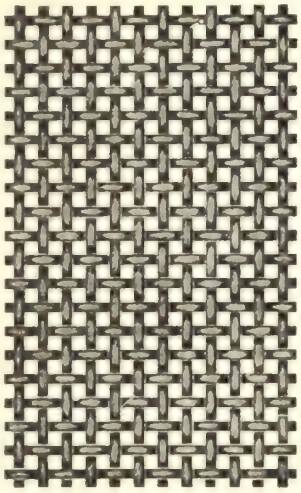

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Especially designed for Mines, Quarries and Contractor's work, such as Pile Driving, Bridge Building, and general Construction work.

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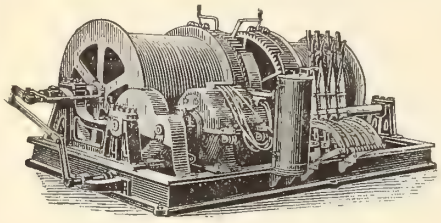

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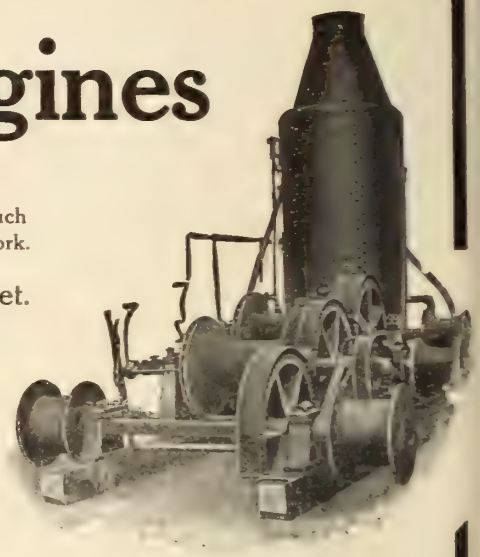

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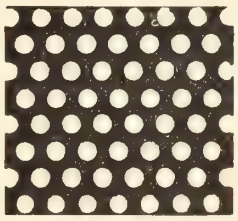

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Elevator Buckets (plain and perforated).
Conveyor Flights and Trough, also
General Sheet Iron Work.

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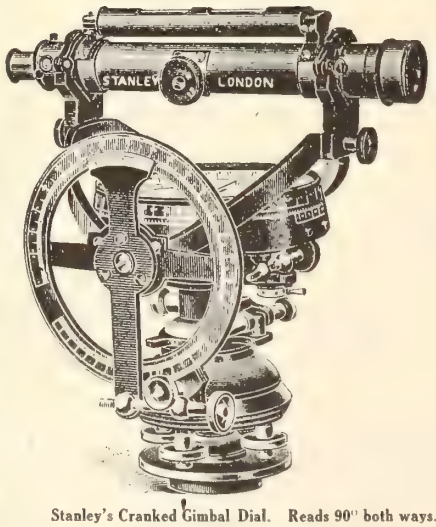

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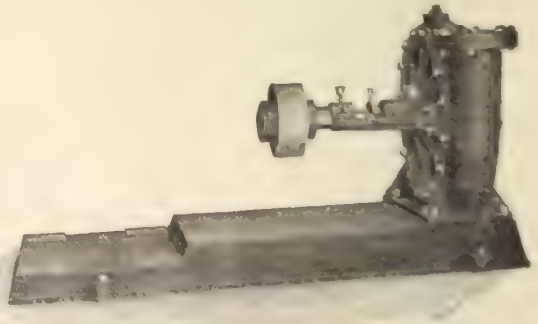

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The Mineral Province of Western Canada

Has produced Minerals valued as follows: Placer Gold, $73,269,603; Lode Gold, $81,595,516; Silver $37,709,282; Lead, $31,468,462; Copper, $86,969,370; Other Metals—Zinc, Iron, etc., $2,198,949; Coal and Coke, $149,814,462; Building Stone, Brick, Cement, etc., $23,807,101; making its Mineral Production to the end of 1914 show an

Aggregate Value of $486,822,745

The substantial progress of the Mining Industry of this Province is strikingly exhibited in the following figures, which show the value of production for successive five-year periods: For all years to 1894, inclusive, $88,904,199; for five years, 1894-1899, $46,906,258; for five years, 1899-1904, $90,391,394; for five years 1904-1909, $121,618,733; for five years, 1909-1914, $139,002,161.

Production During last ten years, $260,620,894

Lode-mining has only been in progress for about twenty years, and not 20 per cent. of the Province has been even prospected; 300,000 square miles of unexplored mineral bearing land are open for prospecting.

The Mining Laws of this Province are more liberal and the fees lower than those of any other Province in the Dominion, or any Colony in the British Empire.

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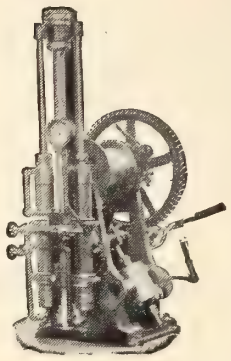

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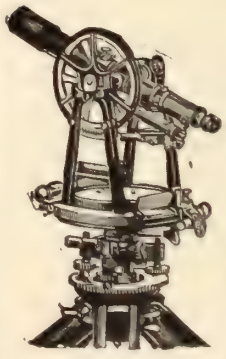

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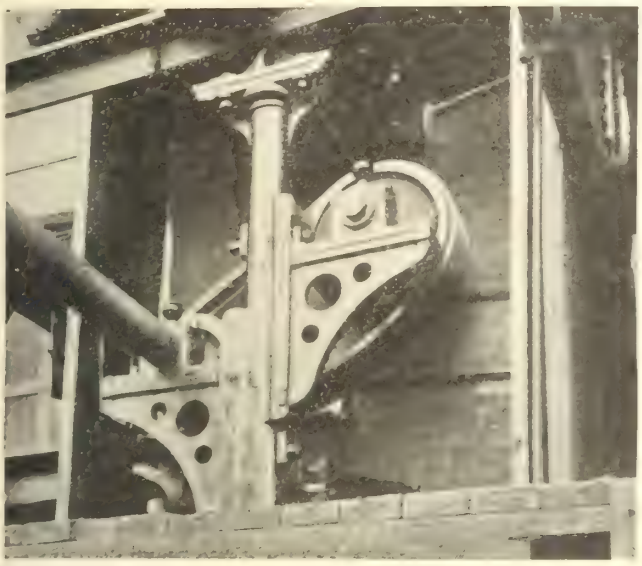

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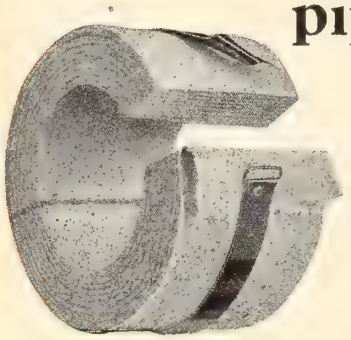

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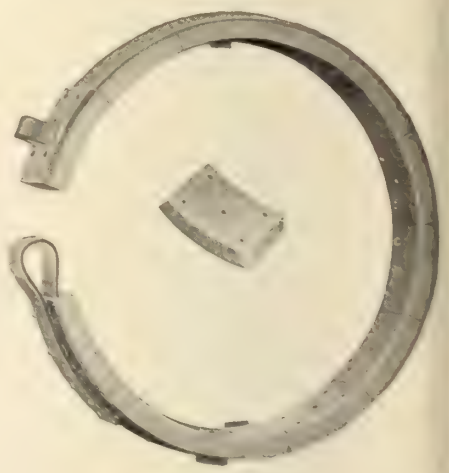

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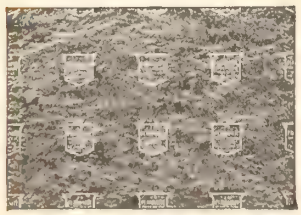

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THE CANADIAN MINING JOURNAL

VOL. XXXVI. TORONTO, October 1, 1915. No. 19

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KOWKASH

In this issue we publish two articles on the Kowkash district, Ontario, where gold has recently been discovered. Mr. P. E. Hopkins, a geologist on the staff of the Bureau of Mines, who has been studying and mapping gold areas in other parts of Ontario, found conditions at Kowkash favorable so far as geological formations are concerned. Mr. Charles Spearman, of Haileybury, also found conditions similar to those in gold-producing areas.

Neither shows an inclination to go into raptures over the gold thus far discovered at Kowkash. They are each able, however, to confirm the report that gold has been found in a district which has not yet been carefully prospected. That should be enough to warrant prospectors going into the district. There is no guarantee that Kowkash will ever be a producing district. There is a fair chance, however, that important bodies of gold ore may be found. In mining you must take a chance. No one knows that better than the prospectors.

EXPORT OF CONTRABAND ORES

The order-in-Council prohibiting export of a number of metals and minerals is making difficulties for producers in various parts of the Dominion. For some of our products there is little market in Canada and the loss of the United States market would be serious. Metal prices are very high just now and it would be folly to interfere with shipments that are not intended for use of the enemy.

As a matter of fact there is no intention to restrict export of metals or minerals, provided satisfactory precautions are taken against such articles reaching the enemy. All the large exporters are aware of this and have been able to export products as desired. There seems, however, to have been more publicity given to the order-in-Council than to the necessary procedure to be followed in making shipments. As a result conditions are by some believed to be worse than they are.

In British Columbia several small operators found themselves embarrassed by the order-in-Council and appealed to the Provincial Mineralogist, Wm. Fleet Robertson, for assistance. Mr. Robertson took up the matter with the Department of Trade and Commerce. Mr. R. Grigg, Commissioner of Commerce, in reply, explained that special licenses are granted by the Customs Department permitting export to the United States after the matter has been investigated.

"If an application is sent in to the Customs Department giving all information as above, it will be sent to investigate and if all the circumstances are approved

of and a guarantee given that the goods are not to be sent to enemy countries a special license is granted."

That some such precaution is desirable few will deny. Unfortunately it makes proportionately more trouble for small operators than for large companies. Some occasional shippers seem to be unaware that any provision has been made to facilitate exports.

CANADIAN PATRIOTIC FUND

The demands upon the Canadian Patriotic Fund are such that an appeal must be made to all for its support. At present 20,000 families are being maintained by the fund at a total cost of $400,000 per month. Applications are increasing as rapidly as ever. The greater our armies become, the greater become also the number of dependants. The longer the war lasts the greater the sum needed to support each family.

Under the circumstances, everyone naturally wishes to contribute to the fund. Some bear more than their share of the burden, while others are satisfied with making a very small contribution.

The employees of some companies have agreed to give one day's pay to the fund. This is a method of subscribing that is especially desirable.

Dr. James Douglas has accepted the chancellorship of Queen's University. The University is to be congratulated. Dr. Douglas is a staunch friend of learning and one of the foremost mining men in America.

Cobalt silver mines are coming more into favor with investors again. Important discoveries have been made during the past few months, and the market for silver has recently much improved.

The Mines Branch has issued a report by Mr. L. H. Cole on the Salt Deposits and Salt Industry of Canada. As pointed out by Mr. Cole, the only salt deposits now being exploited in Canada are those in Southern Ontario. There are, however, extensive salt deposits in Western Canada, which may eventually be worked. Mr. Cole's report contains much interesting information on salt, its occurrence in Canada and methods of treating it.

According to a recently issued Government report, the total number of foreign-born residents of Canada at the time of the last census, 1911, was 752,732, of whom 344,557 were naturalized. The total number from Europe was 404,941, of whom 184,493 were naturalized. The number of alien Germans was 16,294 and of Austrians and Hungarians 60,481. And yet last week the New York World announced that we have 600,000 German-Canadians under surveillance here.

In "United Empire," the Royal Colonial Institute Journal, attention is drawn to the desirability of breaking down German influence in the metal industry wherever it is found to exist. The editorial writer says: "Even prior to the war we had become in far too great a measure dependent on German smelting firms for our supplies—an error on our part which might have been avoided, which has proved costly since the outbreak of hostilities, and which is much too dangerous to be committed again." The determination to encourage the refining of zinc ores in Canada is in line with the policy advocated by "United Empire."

The production of nickel and copper in Ontario is now greater than ever before. Thanks to the wonderful deposits of the Sudbury district and the great demand for nickel, for purposes of peace as well as for war, the nickel mining companies are making unprecedented profits.

Accompanying the recent rise in the market price of Nipissing are several rumors. One is that the company will acquire control of the property of the Peterson Lake Mining Company, which immediately adjoins the Nipissing and could be very economically explored. Coupled with these rumors are the declaration of the regular quarterly dividend of five per cent., and an improvement in the price of silver. There seems to be good ground for the rumor in regard to the Peterson Lake property. As yet, however, no official statement can be made. It is only given out that Nipissing is negotiating for control of a silver property. Increased activity will doubtless follow if control is transferred to the big company.

The gold production of Ontario during the first six months of 1915 was $3,570,072, as compared with $2,011,069 for the corresponding period of 1914. The mines of the Porcupine district have in a few years brought Ontario to the front as a gold-producing province. The indications are that Ontario will continue for years to make a large gold output.

ELECTRO ZINC CO., LTD.

Ottawa, Sept. 24.—Letters patent have been granted to the Electro-Zinc Co., Ltd., with headquarters at Sherbrooke, Que., and a capitalization of $24,000. The incorporators comprise Leland D. Adams of Oakland, California, mining engineer, and Charles H. Maxey of Rutherford, N.J., mining operator. The company will operate mines, smelters and refineries. The bounty recently offered on zinc has no doubt been the inducement for the formation of the company.

THE KOWKASH GOLD AREA

By P. E. Hopkins.

In accordance with instructions from Mr. T. W. Gibson, Deputy Minister of Mines of Ontario, I left Toronto on September 6th, and proceeded to Kowkash to make a preliminary examination of the recent gold discovery in that area.

Kowkash station is 297 miles west of Cochrane on the National Transcontinental Railway. The recent discovery nine miles northwesterly from Kowkash Station near Howard falls on the Kawa-kash-kagama river, shortened to Kowkash.

The canoe route commences one and one-half miles east of Kowkash station at Johnson creek which flows two and one half miles northeast and enters the Kowkash river. Two portages, one of one hundred yards around a log jam, and one of four hundred yards around Howard falls, occur on the Kowkash river. It requires about seven hours to make the twenty miles canoe trip.

Sketch Map showing Route from Railway to Howard Falls, Kawashkagama River

The country is of low relief and consists of rocky hills up to 100 ft. or more in height separated by large swamps, semi-muskegs and sand and gravel areas. The rocky hills are covered with a dense growth of small timber and moss and sometimes large loose boulders, which make prospecting somewhat difficult. The height of land at Redmond, 15 miles west of Kowkash station, has an elevation of 1,122 ft. This northwest and southeast divide separates the waters of the Great lakes from those of Hudson Bay.

Early Exploration and History of the Kowkash Region.—The gold discovery occurs on the river which the Indians call Kawa-kash-kagama, which signifies sparkling water. This name has been shortened to Kawashkagama by the Geographic Board. The National Transcontinental Railway has further shortened the word by naming the station Kowkash, which the prospectors have likewise done to the name of the river. Hence the name of the new gold area.

The part of the Kowkash river near the gold find was examined by Dr. R. Bell and is described in the annual report of the Geological Survey of Canada for 1870-71; also by party number 5, Exploration of Northern Ontario, issued by the Ontario Department of Crown Lands, 1900, p. 156. In this later report E. V. Neelands, geologist with party number 5, blazed the way for the prospector when he stated "Huronian rocks, mainly chlorite and other soft green schists, occur on the Kawa-kash-kagama [Kowkash] river from about four miles below the Wawong portage to the northern limit of exploration (Howard falls)—The most promising district is the country on the Kawa-kash-kagama river below the Wawong portage. Here Huronian exposures are numerous, mostly chlorite and other soft green schists. Several samples from small quartz veins in this district showed traces of gold, and it might be that careful prospecting in this district would be rewarded." W. J. Wilson and W. H. Collins' map number 964 published by the Geological Survey, Ottawa, which roughly outlines this Kowkash Keewatin area is being much used by the prospectors at the present time. (Extracts from the reports by E. V. Neelands and W. J. Wilson were published in the Sept. 15th issue of the Canadian Mining Journal.)

Mr. E. W. King Dodds made his spectacular gold discovery on August 21st, 1915, by walking over the rocky hill below Howard falls, which had been burned clean of moss and trees on the previous day. The news of the very spectacular ore caused a rush of about 400 prospectors to the neighborhood and about 75 to 100 claims were staked within three weeks.

General Geology of the Kowkash Region.—In the Kowkash area is a belt of Keewatin rocks 10 to 15 miles wide and extending from the north end of O'Sullivan (or Sesekenaga) lake in a southwest direction through Howard falls and across the height of land at Redmond. This whole Keewatin area is worth prospecting for gold. For miles around this Keewatin belt are Laurentian granite and gneiss rocks, as will be seen on Wilson and Collins' map.

The Keewatin are largely massive, fine-grained green chlorite and hornblende rocks which are in places altered to schist. Some of the chlorite rock is altered diabase. Numerous exposures can be seen along the Kowkash river from three miles below where Johnson creek enters the Kowkash to within a mile of the driftwood portage. Altered basalts showing the pillow or ellipsoidal structure are common. They are well exposed from Howard falls to beyond the Dodds gold showing, on the portage below Howard falls and around O'Sullivan lake. They are in places gone to chlorite schist. With the basalts are small agglomerate areas. Cutting these greenstones are numerous white-weathering quartz-porphyry dikes up to 30 ft. or more in width. They contain numerous white quartz phenocrysts the size of peas in a grey to green fine ground mass.

Porphyry like that of Porcupine.—The porphyry contains some quartz stringers, is schistose in places and resembles the quartz porphyry at Por-

cupine, Goodfish lake and north of Schreiber. The main exposures seen extend for a mile eastward from Howard falls and around O'Sullivan lake. About two miles below Howard falls and one chain from the left bank is a large hill which has been recently burned. The south fringe of the exposure is a slate and conglomerate similar to the Timiskaming sediments in Porcupine, Kirkland lake and Munro township. The sediments dip vertically and strike 25 deg. north of east. The slate is very cherty. The pebbles of the conglomerate are drawn out and consist of chert, quartz porphyry, amygdaloidal basalt and gneiss. North of the sediments is a large volume of massive pillow lava. Judging from reports the rocks near Redmond may be old sediments. Around the centre portage between Abamasagi and O'Sullivan lakes is a fine slate-like biotite and chlorite schist striking 35 deg. east of north and dipping from 50 to 80 deg. south-eastward. These may be of sedimentary origin. At the last portage into O'Sullivan lake is an actinolite rock, below which are numerous massive serpentine exposures. A gabbro and diabase, probably the youngest rock in the area occurs about 300 yds. north of the Dodds gold find. Dikes a foot in width also cut the basalt on the Dodds claim. The direction of ice movement was 35 to 40 deg. west of south.

E. W. King Dodds' Gold Discovery.

Dodds' gold quartz vein, which is the only reported discovery up to the present, is five-eights of a mile below Howard falls and 800 ft. north of the river. The vein strikes 8 deg. south of east and appears to dip 75 or 80 deg. to the north thus conforming in strike and dip with the country rock. The vein which is somewhat lenticular is up to 4 or 5 in. in width and can be traced about 40 ft., ending in drift on either end. The quartz is glassy and largely free from sulphides. Spectacular gold was seen in place over an area about five inches long and one inch wide. This showing extended five inches along the hanging wall side of the vein. Similar and richer specimens were reported to have been taken from the four or five feet adjacent to the showing. On the hanging wall side of the vein is a rusty schist band six inches wide and heavily mineralized with fine pyrite. The wall rock is pillow lava (basalt) which is altered to schist in places. A mineralized quartz-porphyry dike occurs about a chain south-east of the gold showing.

Other Resources.

The timber is mostly second growth some of which has been recently burned. The trees consist of small spruce, poplar, balm of gilead, pine, birch and cedar, some along the river attaining a diameter of two feet. There is some good agricultural land. Whitefish, pickerel, pike, suckers and brook trout up to two feet long are plentiful in the Kowkash river. W. J. Wilson speaks of Howard falls as follows: "This fall is caused by a ridge of chloritic hornblende schist through which the river cuts, making a narrow canyon-like gorge fourteen chains long. This gorge is from twenty to thirty feet deep, and the water descends in steps and slides varying from one to five feet. The fall would make a splendid water-power."

Dodds' and Surrounding Claims, Kowkash District

Conclusion.

The geological formation of the Kowkash district is somewhat similar to that of the Big Duck lake area north of Schreiber,* 100 miles south, Goodfish lake (Morissette township) and to Tisdale township in the Porcupine gold area. Numerous small glassy quartz veins some of which are mineralized with pyrite occur over the whole area, the Dodds vein containing a very spectacular gold showing. This would suggest the advisability of a thorough prospecting of the Keewatin area.

All the information on the area is being compiled by the Ontario Bureau of Mines, and a map will be published about October 1st.

*See Map No. 24b, Part I, Vol. 24, Bureau of Mines, Report, 1915.

THE KOWKASH DISTRICT, ONTARIO

By Charles Spearman.

Northern Ontario has once more come into the limelight, a rich discovery of gold having been made on that part of the northern watershed of the Height-of-Land, drained by the Kawashkagama (Kowkash) river. Kowkash station—the telegraph office and nearest railway station to the new discovery, is about three hundred miles west of Cochrane on the Government Transcontinental Railway. As the crow flies the new discovery is about fifteen miles north-west of Kowkash station, but the railway could be reached in ten miles or so by following a line directly south from the discovery. Here is another instance where the Ontario Government operates a Pullman service into the very heart of a resourceful area and within a step of a new discovery, as was the case with Cobalt, Swastika, Kirkland Lake, Kelso, Porcupine, Munro Township, Sesekineka, etc., all located within the last ten years. It appears that wherever a new railroad line is constructed to open up a portion of [illegible] ing valuable mineral resources.

The Kowkash district lies in the Thunder Bay dis- [illegible] Port Arthur mining division, and embraces an area of about five hundred square miles. This area presents a flat, monotonous topography, relieved here and there by such glacial phenomena as kames, eskers, moraines, etc.; the highest point being the Height-of-Land, which roughly speaking parallels the Kowkash river on the western side, at a distance of from eight to ten miles from the river, and has an average altitude of about twelve hundred feet, in this district.

Nearly all the area may be classified as [illegible] "muskeg," covered by dense vegetation consisting of various kinds of mosses and such evergreens as spruce, jack pine, balsam, some cedar and tamarack, most of the latter being dead but still standing. Of the deciduous trees, poplar, alder and birch are abundant on the higher ground. The mosses in places form a carpet over two feet thick, which is usually underlaid by a stratum of decomposed vegetable matter (muck), then comes a stratum of a firm plastic homogeneous grey variety of clay resting on bed rock. As revealed in the railway cuts and river banks, the total depth of overburden is not very great, probably not averaging over three and a half feet, of which from six inches to two feet is moss. Often in the lowest portions of the area bed rock is found with a shallow mantle of moss; but this is rather the exception.

Small areas have been fire swept some time ago and present typical "wind falls," especially in the low mossy ground, where the dead trees are interlocked in almost inextricable confusion. It appears that most of the roots were in the decomposed vegetable stratum underlying the moss, and when this covering was slowly removed by the fires the trees were deprived of the support of the roots. These dead trees rest on the clay stratum, and when visited by fires a clean sweep is the result, leaving exposed the clay in good shape for trenching operations. A typical example of this is seen on the King-Dodds "discovery" claim.

On the Portage at Howard Falls, Kawashkagama River

The streams of the area are comparatively large, and on the whole sluggish, except for occasional falls and rapids and [illegible] meander about one hundred per cent from the direct line. Numerous small brooks and creeks, famed for their excellent speckled trout, empty into the main watercourses.

The history of the Dodds discovery dates back scarcely two months. It appears that E. King Dodds, equipped with the necessary grubstake and Wilson and Collins' geological map, was exploring the Keewatin area of Northwestern Ontario in the hope of finding gold. He camped at Howard falls, commenced prospecting among the debris of a [illegible] burnt area [illegible] rapids and downstream are outcrops of [illegible] it is said that he then started a fire in the "wind fall,"

which swept it practically clean of all organic matter and left exposed, for about two feet, a four inch quartz vein. This portion of the vein was phenomenally rich. Portions of ore broken off weighing several ounces were about twenty-five per cent. native gold. Just after the discovery, Dodds met Armstrong, a civil engineer, Pearce, an editor of a Toronto paper, and Powers, a prospector of Haileybury, returning from investigating a reported silver discovery in Northwestern Ontario. They made arrangements whereby Armstrong, Pearce and Powers staked around the Dodds discovery. Then the news got to the outside world, and soon scores of canoes and hundreds of prospectors hailing from all parts of America began to descend the stream from the railway to the scene of the discovery.

Johnson Creek, National Transcontinental Railway

Kowkash Station, National Transcontinental Railway

The Kawashkagama river.—The trains usually stop at Johnson Creek, one and one-half miles east of Kowkash station, and it is from this point that the trip begins. The westbound "National" is due at Johnson Creek at 2 a.m., and immediately after detraining everyone makes preparation for an early start in the morning. Johnson creek, a tributary of the Kowkash river, is a rather shallow meandering stream with low banks, and an average width of about 25 feet. From the railroad to the point where it joins the river, is about four miles in length. Three miles down stream from the confluence, Rupert's falls, a small rapids, is reached. This is easily run; but must be "portaged" or "poled" on the return. About two and a half miles further down stream the first outcrop of rock is seen on the right bank of the river. It is a green Keewatin chlorite schist, showing abundant pyrite, striking nearly east and west and standing almost vertical, and having a slight dip to the southeast. Occasional outcrops are seen along the rest of the route to Howard falls, and are for the most part schistose derivatives of the medium acid Keewatin rocks, together with such massive basic rocks as gabbro, diabase, diorite, etc. Ten miles down stream from Rupert's falls is the first portage, where the river is blocked for a hundred feet or so by driftwood. About five miles further on Howard falls is reached. The total head at this falls is about nineteen feet and drops in three cascades, each separated by a couple of hundred feet. The second portage is at this point and is seventeen chains in length—across the island which divides the falls. Fifteen minutes from the falls the Dodds

"discovery" is reached. About four miles north from Howard falls is located another falls with a drop of about fifteen feet or more, and, like Howard falls, is divided by an island. From this point into Abamasagi lake, ten or twelve miles, the river is much shallower and wider, averaging about one hundred and fifty feet as compared with about a hundred feet for the first portion, and contains many boulders which just come near enough to the surface of the water to catch a canoe, and it is a familiar sight to see where canoes have registered on the various rocks by leaving a small patch of the particular color of paint with which the canoe was covered. The current in this portion of the river is relatively strong, due to the shallowness.

At the point where the river empties into Abamasagi lake is located an Indian encampment. These Indians do not understand English or French, and no information regarding the country could be gathered from them. The Kowkash river empties into a shallow weedy portion of Abamasagi lake, and almost immediately turns sharply to the east and empties into Sesekenaga or O'Sullivan lake. Between the above two large lakes, the river maintains its main characteristics as to size, etc., and three short portages mark the only interruptions on this eight mile course. There are many rock exposures along the banks, and in many places the river follows the general strike of the country rock, approxi-

On the Kawashkagama River—Meal Time

Rapids About 4 miles below Howard Falls

mately east and west, and thus [illegible] the vertical walls of the [illegible] schist. The exposures along the river and on O'Sullivan lake are principally schists derived from more or less basic rocks and Laurentian granite and gneiss. Many quartz veins are present,

but most are apparently barren. Some of the schist on the south shore of O'Sullivan lake is well metallized with pyrite and some of the quartz veins contain much pyrite. There is another Indian encampment where the river empties into O'Sullivan lake and also near the mouth of the river on the south shore of the lake.

The geological reconnaissance by Messrs. Wilson and Collins, made in 1903-4 will convey a very good idea of the geology of the area (see Sept. 1 issue). According to their investigation, there is a Keewatin "core" bounded on the west by the Height-of-Land, on the northwest by a line drawn from the source of the east branch of the Kowkash to the northeast arm of O'Sullivan lake, excluding Abamasagi lake, which lies within the Laurentian, on the east by a line drawn from the northeast arm of O'Sullivan lake to Rupert's falls, and thence to Fleming lake, and bounded on the south by a line drawn from Fleming lake to a point southwest to the Height-of-Land and beyond. The formation within this "core" and as seen at the very few exposures is made up of Keewatin greenstones, both massive and schistose. The massive varieties seen being acid quartz-porphyry, felsite, rhyolite, andesite, andesite porphyry, quartz diorite, diorite, gabbro, diabase, vesicular obsidian, etc. The schistose varieties are derivatives from the above massive rocks and may be classified as sericite and hydromicaceous schists, hornblende schist, biotite schist, chlorite schist, etc.

The general strike of the formation in this area is a little north of east, and in general the dip is nearly vertical.

The Dodds Discovery.—At the Dodds "discovery," the vein complies to the strike of the formation, which is about fifteen degrees north of east and probably dips with the formation. The wall rocks are sericite or some hydromica schist, and chlorite schist, the whole being much impregnated by pyrite. Several quartz-porphyry intrusives are exposed not far from the "discovery." No development work has been done on the discovery to date.

From the standpoint of the prospector, there exists to-day a no more promising area for exploration than that just outlined above. In many places throughout the area the geological conditions strongly resemble that of the Porcupine district. It is unfortunate for the district that most of the bedrock is obscured by organic matter, but experiment has shown that this may be removed if the proper steps be taken, rendering subsequent exploration comparatively easy. There are numerous other Keewatin outcrops scattered here and there throughout a vast area outside of the Kowkash district in Northern Ontario, which are well worthy of earnest investigation and are easily accessible by means of the various water routes, on which headquarters could be established for the exploration of the surrounding country.

INTERNATIONAL NICKEL.

International Nickel Co. reports to Stock Exchange a consolidated general profit and loss statement for four months ended July 31, 1915, as follows:

Gross earnings, $4,411,049; other income, $40,353; total income, $4,451,402; expenses and taxes, $272,528; net income, $4,178,874; depreciation $488,494; surplus, $3,690,380; common dividends, $1,901,575; balance, $1,788,805; preferred dividends, $133,689; profit and loss surplus, $1,655,116.

GOLD STRIKE AT MONTAGUE MINES.

By W. R. Bateson.

Apparently once again is the Montague Gold District about to justify its long standing reputation as a rich gold producer, if one may judge by indications that have come to light during the past summer.

As was to be expected from past experience, it is in the "Skerry Lead" in the Simon Kaye Property where the very encouraging discovery has been made: a find not only encouraging because of its richness; but chiefly so because it occurred below the "break," which is in this case a plane of faulting intersecting the "Skerry Lead" in this place at a depth of 65 ft., and throwing it 30 ft. to the south.

Now all the previous rich ore in the "Skerry Lead" was found above the fault, and some mining men were of the opinion that the lead might be lean below the fault. The writer always held the opinion that as the fault occurred long after the formation of the lead, it would have no influence upon it; which opinion now seems to be confirmed.

The enrichment is due to a small quartz "angular" or stringer coming from the south and cutting through the slate belt until it struck the "Skerry Lead." The plate, in the immediate neighborhood of the quartz of the "Skerry Lead" is highly mineralized with mispickel for some distance below the point where the "Angular" met the lead. The "Angular" seems to follow the lead downwards, and to have enriched it along its course. The gold occurs coarsely disseminated in the quartz, but in immediate contact with the mispickel near and in the slate. The lead varies in width from one to six in., but the south side of the lead seems to contain the most gold.

The specimens of ore obtained in August are very spectacular, and probably exceed 250 oz. to the ton in richness. Now that the development of the mine where this enrichment occurred is being continued well below the fault there is a probability of any zones of good gold bearing quartz continuing uninterruptedly to considerable depths. In the probable assurance of this fact lies the chief value of the discovery made in the Montague Gold District in August.

KEUFFEL AND ESSER.

Keuffel and Esser have been awarded three grand prizes for exhibits at the Panama Pacific Exposition.

The exhibit comprises every requirement of the engineer for field or office work. The engineering instruments displayed include instruments of every type, from the small hand instruments used for the roughest preliminary survey to a triangulation theodolite, reading angles to single seconds, and a photo-theodolite, representing the finest types of precision instrument construction. Many new improvements and time and labor saving devices are being shown, among which may be mentioned the K. & E. stadia circle, a device simplifying to the last degree the reduction of Stadia measurements and obviating the necessity of using the charts, tables and slide rules now familiar to the engineer. The slide rules shown include many new types.

The Surveyor's Slide Rule reduces the calculation of azimuth-meridian and stadia reductions and other hitherto complicated calculations to mere mechanical operations and enables the engineer in the field to compile these data using the ordinary engineer's transit fitted with vertical circle.

STRUCTURAL FEATURES OF THE PORCUPINE ORE DEPOSITS

By Alfred R. Whitman

There has already been much good work done on the geology of the Porcupine district, and many valuable contributions made to technical literature. Of the many contributors Mr. A. G. Burrows of the Ontario Bureau of Mines was one of the first in the field and has devoted the most study to its phenomena. Therefore since this discussion is limited to the structural features, the reader is referred for a background of general geology to Mr. Burrows' writings, particularly those in the bulletins of the Ontario Bureau of Mines. To facilitate further reference a general bibliography is also appended.

The writer entered the field in January, 1914, as geologist for the McIntyre Mine under the management of Mr. R. J. Ennis, being the first person regularly employed in that capacity in the district. The utility of work of that sort was to be demonstrated, and it thus became urgent early to discover what line of study would yield the most prompt economic returns. It soon became evident that this line would be structures.

Certain structural features, and unfortunately the most important ones, cannot be discussed in this brief article, but in these studies certain other significant aspects of the structures were developed, and will be described.

In pursuit of these studies the neighboring surface was worked over to good advantage, and the other mines kindly rendered assistance by giving the writer access to their underground workings. As a result of these general investigations it became apparent that no rules of structure bearing upon the whereabouts of unknown ore-bodies or the continuity of known ones could be made to cover all cases, each small locality having its own peculiarities. This proved true to a remarkable degree, since the five chief types of ore body have thus far proven to be almost completely limited to five of the principal properties of the district, one type to a property with a single exception.

Types of Ore Bodies, Porcupine Gold Deposits.

Dome Type. This type having received the least study is least understood. It is best developed at the Dome Mine, where the discovery outcrop which gave the name to the mine and the type of ore body was a great dome-shaped mass of white quartz. The complete form of one of the high grade bodies, as described by Mr. C. D. Kaeding, the manager, is similar to that of a pear or plum stood on end with the large end uppermost. Of this relatively high grade mass the upper portion is chiefly quartz, the lower part consisting essentially of mineralized schist and scattered irregular veinlets of quartz. As the management expresses it, they have found other plums in their pudding. The "pudding" is a mineralized belt in which these ore bodies lie surrounded by aureole-like areas of low grade ore. The first "plum" had cross sections of 100 ft. and 200 ft. and an extreme depth of 400 ft., having lost most of its upper portion by erosion. The second one has not been completely explored but is known to have cross sections of 300 ft. and 60 ft., and to extend from the 257 ft. level, below the 550 ft. level, being elliptical in cross section and more variable than the first.

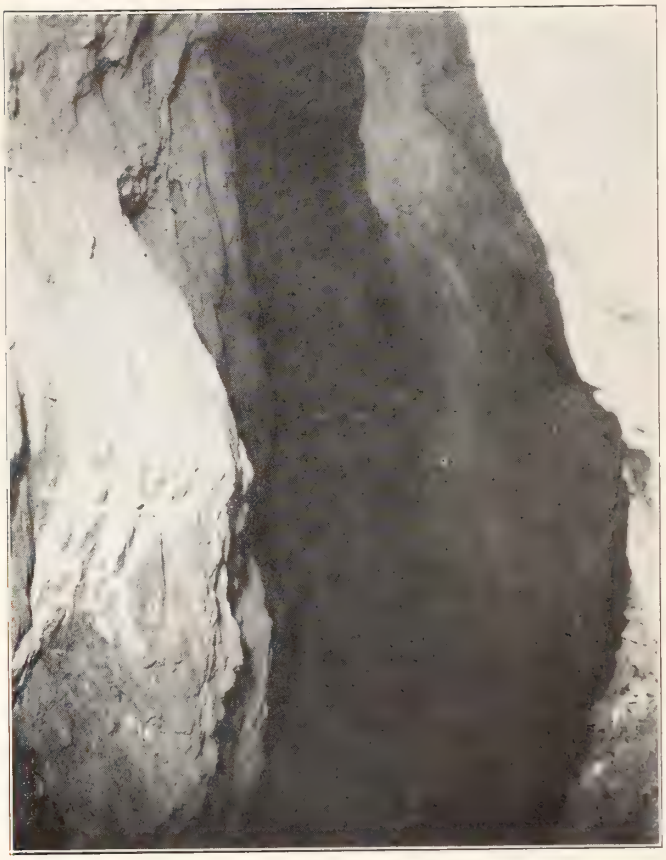
The structure is ill-defined but is appears originally to have been essentially a region of differential strains in which irregular fractures were developed and a certain permeability produced in the schist, rendering the affected rock susceptible to general impregnation with auriferous pyrite and free gold, and erratic silicification and replacement by quartz, through the agency of ascending solutions.

In addition to these two "plums" other smaller ones of similar character have been found. The mineralized zone in which these occur lies immediately north of the contact of the chief local boss of quartz-porphyry and mainly south of the sedimentary rocks referred by Burrows and Miller to the Temiskaming period.

Lode Structure. No. 517 Stope, McIntyre Mine

Lode Type. This type, as best exemplified on the Hollinger property, has been most carefully studied. The ore bodies included in this class have always been referred to as veins, which designation is not altogether inappropriate in common usage, since they are essentially vertical tabular bodies ranging in length to 1000 ft. or more, and in width to over forty ft., being in many cases nearly solid masses of quartz. They are here classed as lodes (1) because they were not formed in fissures nor sharp lines (2) because they are essentially not

solid masses of quartz formed either by crustification or by accretionary growth, but are substantially masses of quartz veinlets with inclusions and partitions of mineralized schist. Often these veinlets of quartz coalesce over widths of thirty ft. and for considerable distance; but however much coalescense may prevail the mode of origin and the general structure are of the lode type, e.g. Nos. 1 and 4 veins of the Hollinger Mine. As a special case under this general definition, another variety



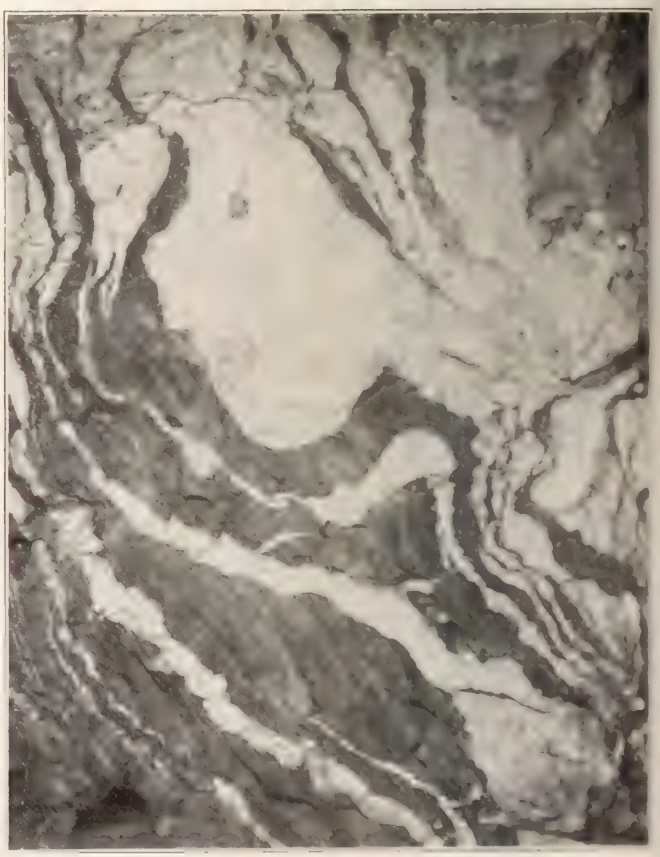
View Showing Form of Orebody of Lode Type. Looking East in No. 310 Stope, McIntyre Mine

of lode is certain zones of mineralized schist with only a few quartz veinlets, e.g. No. 2 and No. 5 veins of the Hollinger Mine. The quartz lode is also well exemplified on the McIntyre property south of Pearl Lake in No. 310 and 4M veins. Neither sort of lode is characterized by well defined walls, but both are conspicuously lacking in them, the country rock outside the quartzose portion of the lode often being mineralized and containing high values several feet away. Ignoring this cause of irregularity, definite walls would still be lacking, as the veinlets of gold bearing quartz penetrate out irregularly into the schist and are not uniformly arranged. Usually a given lode varies in width considerably and rapidly from point to point, leaving, after excavation, stopes of wavy contour with smooth but often extreme embayments and constrictions.

Within the walls, such as they are, the quartz veinlets and mineralized schist are distributed in various proportions, sometimes one dominating to the exclusion of the other. Usually both take the form of nearly vertical tablets intermixed with each other. At times where quartz is dominant it is represented only by thin discontinuous sheets or seams giving a banded appearance to the quartz masses. Where the schist is dominant the quartz veinlets conform roughly to the lamination and fractures of the schist as if of subsequent origin.

Often this banding in the quartz veins is conformable to an irregularity in one of the walls or both, as if the irregularity had been there in the schist first, and the vein had grown around it leaving remnants of it, like shore lines, in the vein which had gradually replaced it.

The absence of any sharp walls and the irregularities in dip and strike of the lodes, as well as the absence of any indications of planes of rupture at the ends of the lodes in continuation of them, precludes any possibility of their having formed on faults or shear zones. In fact study has made it clear that they have formed in zones rendered permeable by tension strains. There were few or no open spaces such as could give rise to crustification phenomena, but within the limits of certain zones lateral tensile stresses produced lines of minimum compression allowing the ascending solutions which are presumed to have given rise to the veins, an opportunity to circulate upward among the foliae and minor fractures and joints of the schist.



Contact Lode Structure. No. 417 Stope, McIntyre Mine

Fissure Vein Type. The Jupiter Mine has a vein which well illustrates this type of ore body, but probably an even better example, and one which has been much more closely studied, is No. 5 vein of the McIntyre Mine, on the north side of Pearl Lake. This vein was the first recognized by the writer as being of this type, and constitutes an excellent example.

In the most restricted sense, wherein a "true fissure vein" is a crustified deposit formed in an

open fissure, the term cannot properly be applied to this vein, nor to any other in the district; but the sense in which this is called a fissure vein is that it was formed along a thrust fault, through the replacement of its hanging wall.

No. 5 vein of the McIntyre is a banded vein of irregular width, with a well defined foot wall and no distinct hanging wall at most points. Here and there where a strong joint or an old fault converges with the foot wall or lies near to it, the vein has

Unfaulted Masses of Ore, showing Origin Subsequent to Joints and to Schist Structure. No. 311 Stope, McIntyre Mine

adapted it as a hanging wall, and confined itself within it. But generally the hanging wall side of the vein is irregular and ill-defined, merging into the country rock either by the diffusion of values or by the extension of quartz veinlets into it. The average width approximates 4½ ft., although ranging from one in. to forty ft. The foot wall strikes a few degrees north of east in its western part and as much south of east in its eastern part, dipping at about 65 deg. to the north; but the latter portion is so narrow as to be unworkable, the greatest widths occurring where the strike is most northerly.

The footwall is smooth in many places and slickensided, with a thin film of gouge on it, although frequently mineralization has penetrated it. In one case this had occurred to such an extent that a 12 ft. width of vein extending for 20 ft. along the foot wall had formed beyond.

The bending of the vein is attributed to the mode of its growth, the bands which are of mineralized schist being regarded as residues from incomplete replacement of the hanging wall as the vein expanded outward by a process of metasomatism. Many angular inclusions of mineralized schist, within the vein, about which are similar bands, tend to support this view.

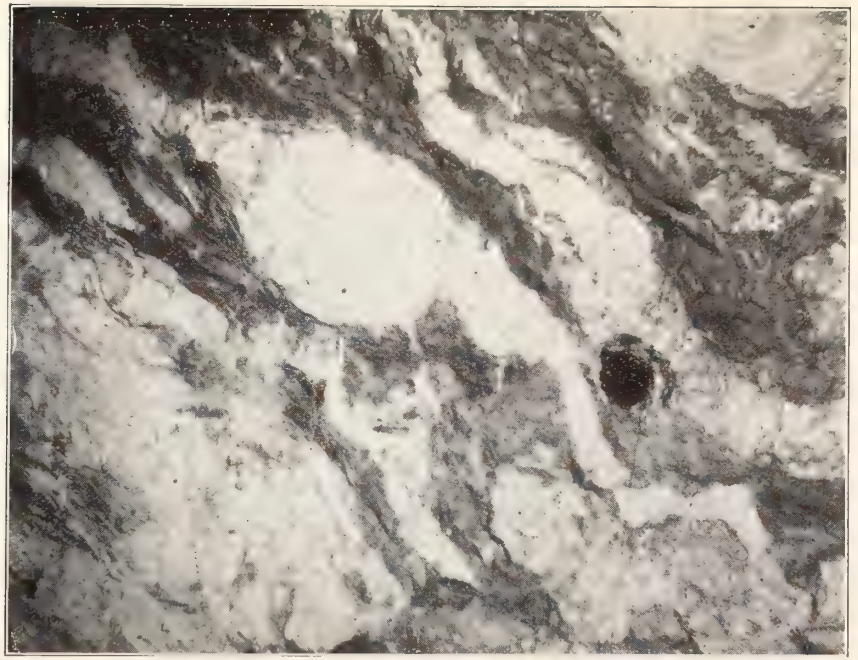
Contact Vein Type.—As distinguished from the fissure vein and contact lode types, this sort of vein finds its sole representative in the Porcupine Crown Mine. Here, the orebody, which appears to have been somewhat contorted by subsequent pressure, follows approximately the contact of a quartz prophyry stock with the older volcanic series. It does not lie along the contact at all points, since this is extremely irregular, but it conforms to it as well as a single fissure could, cutting across both promontories and embayments in the margin of the intrusive mass. As tentatively believed by the management, the channel in which the vein formed by replacement of the channel walls seems to have been a tension rupture, due perhaps to the contraction of the intrusive stock on cooling.

Contact Lode Type.—The most studied and perhaps the best representative of this type of deposit is the "contact vein" of the McIntyre Mine. It was most typically developed where mined in stopes Nos. 317 and 417, north and north west of No. 4 shaft.

View showing Banded Structure at Margin of Vein, indicating Metasomatic Growth of Orebody. McIntyre Mine

This body consisted of a mineralized zone along the contact of the basaltic schists with the south wall of the quartz-porphyry stock underlying Pearl Lake. In this zone were usually many veinlets of quartz, sometimes coalescing and again remaining separate, or perhaps even dwindling in size and number until the quartz constituted only a small proportion of the millable material. The schist in this zone was usually impregnated with finely crystaline auriferous pyrite and free gold, while the

Thrust Fault, showing Phenomenon of Drag in Schist. Looking East, 400 ft. Level, Pearl Lake Mine.



Lode in Quartz-Porphyry, Indicating Formation of Ore to be subsequent to Development of Schist Structure in Rock. 200 ft. level, No 15 Shaft. McIntyre Mine.

Thrust Fault, showing Increasing Throw Upward, lower veinlet is thrown of the district. Looking west. 200 ft. shaft station. No. 1 Shaft.

Cross Veining. No. 311 Stope, McIntyre Mine.

quartz often carried small quantities of scheelite and zinc and iron sulphides, with free gold grains occasionally in spectacular aggregates.

Like the Lode Type of the Hollinger the quartz veinlets have a general tendency to conform with the schistosity, but frequently vary from it within the zone in freakish and fantastic ways. At certain points a discordance was observed in the attitudes of laminae of the basaltic schist, and of the quartz porphyry. In general however, conformity was produced by lateral pressure both before and after the formation of the ore body, which resulted also in the bending of the schist laminae into approximate parallelism with the lode in immediate contact with it.

Significance of Structures.

In all the ore bodies described above there are to be found inclusions of schist surrounded by undeformed vein matter. The general crushed condition of the vein quartz is sufficient evidence in itself, of deformation of the ore bodies; but in spite of this, there are spots virtually free of such crushing, and even at such points in many instances are to be found inclusions of schist as much altered and foliated as that outside the vein, showing that the wall rock had been in a schistose condition before the formation of the ore bodies.

Many cases have also been found in conjunction with lodes and irregular ore bodies, of the local conformity of ore masses with joints. Sometimes this conformity consists in a veinlet lying in a joint, and at others in the limitation of an ore body or the control of its form by a joint. Evidence of this sort, which is abundant, is regarded as indicating the greater age of the joints.

Here and there ores are found in the quartz porphyry, sometimes being entirely enclosed by it, and sometimes running into it from the surrounding schist. In such cases the usual structure is that of the lode type, the constituent veinlets of the orebody tending to conform to the foliae of the schistose quartz-porphyry, indicating that even the quartz-porphyry intruded into the schistose basalts had itself become a schist by the time the veins were formed.

The genetic significance of the structures lies chiefly (1) in the conformity of the ore bodies to schist laminae, joints and faults, and (2) in the banded character of some of the veins. Both these features, together with the absence of symmetrical banding and comb structure which is taken as indicating crustification in open fissures, point conclusively to replacement as being the mode of origin of the ores, the solutions having evidently circulated among the schist laminae and along the joints and faults replacing the rock along these channels of flow with quartz and other vein matter.

That metasomatism was the mode of replacement is indicated by an internal structure of individual quartz veins. It consists in an almost universal fringing of the veins and veinlets with a border of ferrodolomite. This fringe or border of carbonate varies from a quarter to one sixteenth of an inch in most cases, but sometimes is much narrower, being invisible to the naked eye in unweathered veins and only being detected in weathered outcrops by a thin band of limonite resulting from the oxidation of the iron in the carbonate.

Under the microscope the function of this indispensable border of carbonate is most clearly seen. On the vein side, the contact of the quartz and carbonate conforms to the molecular structure of the rhombohedral grains of carbonate, penetrating into the cleavages, and frequently preserving their structures. This shows that the quartz replaced the ferrodolomite, molecule by molecule. On the other side the carbonate band is in contact with the wall rock. On this contact the ferrodolomite penetrates in among the schist laminae in such a way as to show that it was the growing front of the vein. The carbonate, however, does not preserve the schist structure, since the force of crystalization of the rhombohedral aggregates was so great as to destroy the foliae they invaded.

This matter of the replacement cannot be dwelt upon in the present discussion, further than to say that the evidence points to this order of events during the growth of the veins; there was essentially but one period of mineralization, in which the same solutions produced the various effects, first replacing the silicates of the wall rock by ferrodolomite, and then promptly replacing the latter by silica. This probably signifies local automatic oscillation of the conditions of chemical equilibrium, in the mixed solution, carbonate being the more stable in the presence of the silicates, and silica being the more stable in the exclusive presence of carbonate.

It may also be mentioned that the time precipitation of the sulphide, gold, and scheelite, was during the replacement of the carbonate by silica.

Faulting.

One of the most important structural features is the faulting. It was not confined to any one period in relation to the veins, both preceding and following them, and to some extent probably going on at the same time. The faults antedating the veins are important as forming the loci of the veins, while those succeeding them are of importance as constituting the substance of some of the most vital problems connected with the finding and mining of ore bodies.

Of the Post-vein faulting one of the most notable features is the fact that all the faults known are due to thrusting, there being no gravity faults as yet recognized. But these are not known to conform to any single large system of which there is a major or sole fault of great dimensions underlying the entire system. On the contrary, the schists seem to have constituted such a relatively plastic medium, that the compressive stresses where relieved by fractures were taken up by many faults of lesser throw and more or less promiscuous arrangement. It may be said, however, that these lesser faults often occur in small groups or systems, the greatest known major throw being 130 ft.

These faults dip into all but the northwest quadrant, but the greater proportion and most significant of them, dip into the southeast quadrant, the average dip being south of southeast.

Three sorts of systems have been recognized:

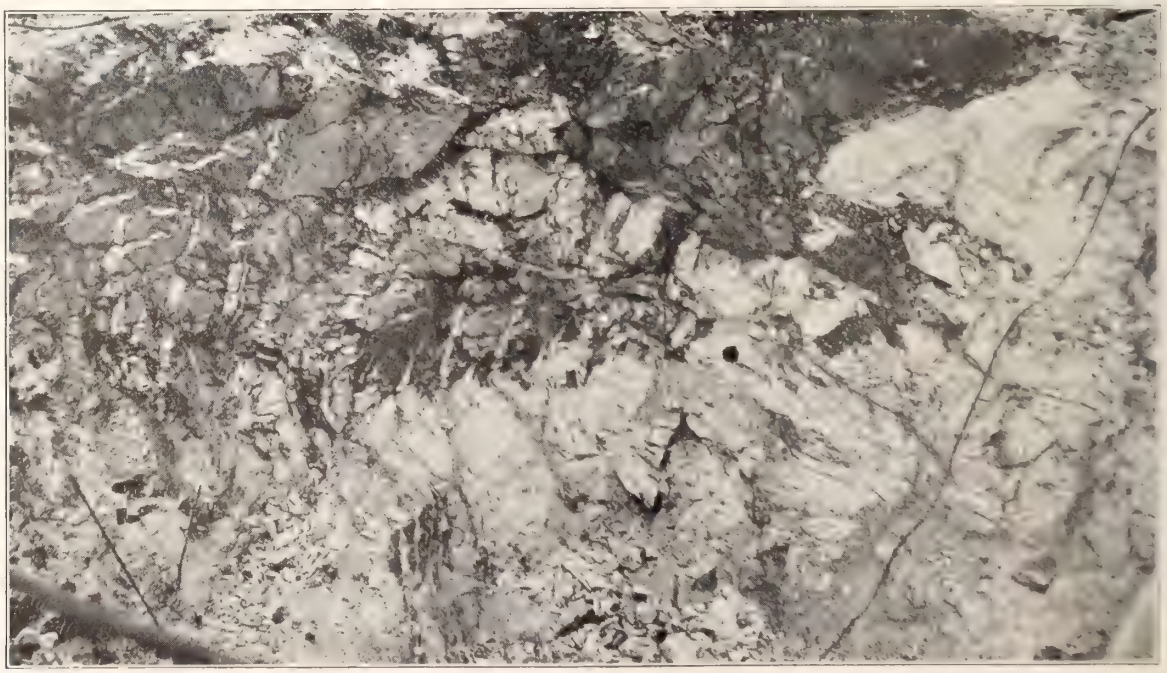
(1) **Step faulting,** which is similar to that recognized in gravity faulting, consists in the taking up of a thrust dislocation by a number of closely related parallel faults. A case of this kind was well developed in No. 315 Stope of the McIntyre Mine, the thrust being from east of northeast, and the dip being at about 10 deg. in that direction. In these, quite flat faults, the surfaces of movement were undulating and deeply corrugated along the line of movement. The total throw was about 15 ft. The number of steps or minor faults

Gold Quartz, Dome Mine

seemed to vary, however, one giving place to two or three over-lapping ones, or vice versa.

(2) **Pairs and trios are usually arranged after the same manner as the great thrust systems** in which there is a distinct sole with minor steeper subsidiaries in the hanging wall side. However, these systems are not here arranged in the manner illustrated by Leith in his "Structural Geology." That is, all the faults do not focus, nor is there a set of subsidiary faults connected with the major one, but all along the dip of the major fault which may have an inclination of from 35 deg. to 65 deg. there are steeper branches running off into the hanging wall side, and from these in many cases similar steeper branches of still less throw going off into their hanging walls. This phenomenon is well illustrated in Faults No. 5 and No. 41 of the McIntyre Mine, on the former of which the major throw was 110 ft.

(3) **Block faulting,** although well illustrated at several places, is best exemplified at the Porcupine Crown Mine, where after a period of tedious and skilful work the faulted vein was recovered beyond one of these systems of block faults. In this system two principal faults bounded a wedge shaped block three hundred feet across at the widest part within the mine workings. On the bounding faults the throws were nearly equal. They converged toward the south west and in depth, the dip of the more northerly one being into the south east quad-



Gold Quartz, Dome Mine

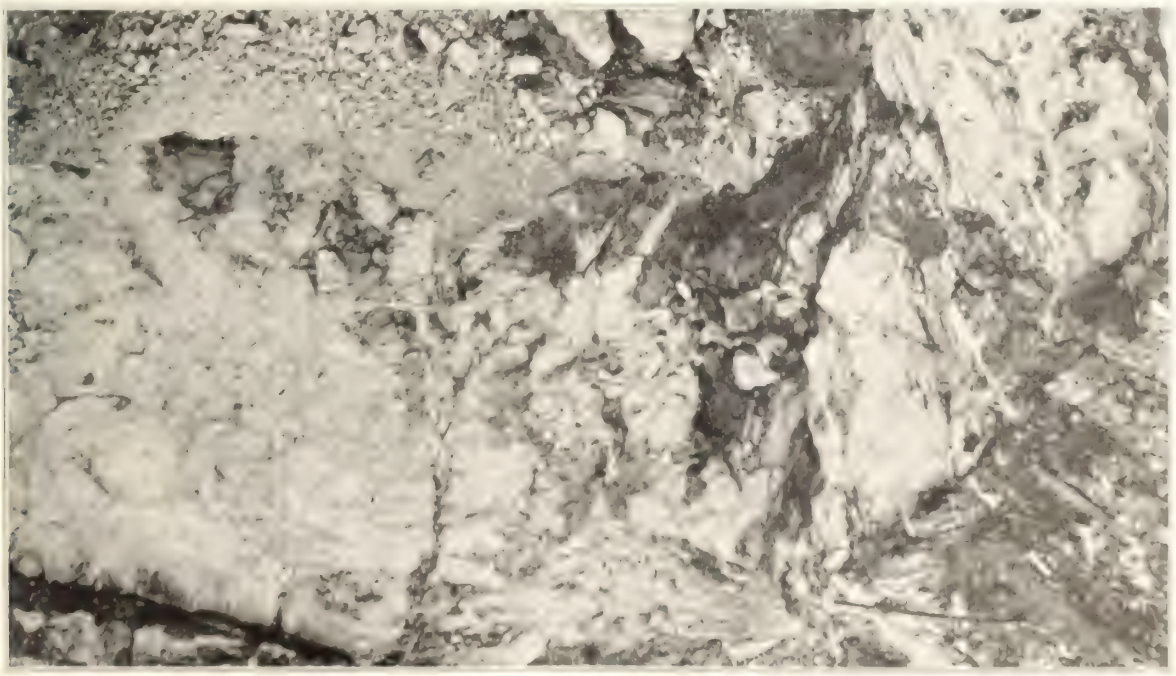
Gold Quartz, Dome Mine.

rant at about 68 deg. and that of the more southerly into the northwest quadrant at about 78 deg.

All the phenomena capable of being depicted graphically have been faithfully represented on the mine maps, giving an excellent record of what was found in the search for the lost vein. From a study of these maps, it appears that within the wedge-block there was a surprising amount of minor faulting both of the block and step types, representing powerful crushing effects. It is to be hoped that some day this data may be published, as it is a very instructive example of block and step faulting under compression.

Dragged ore fragments are frequently found in large faults, and the schists adjacent to such faults often show drag phenomena. The fault surfaces are also corrugated due to the irregularities of hardness in the walls, thus indicating the line of movement of the fault, the drag indicating the direction.

Another notable feature of the faults in these schistose formations is that although there are several faults of large throw (110 ft. and 130 ft.) whose ends have not yet been found, the majority of smaller faults of throw less than fifteen ft. are of short length and depth, the throw diminishing rapidly in all directions from the maximum point. In other words they are quite finite and often circumscribable within the mine workings. Notable examples of this are found in the McIntyre Mine in the cases of Faults Nos. 17 and 40.



Gold Quartz, Dome Mine.

This is due to the plasticity of the schists, acute stresses being quickly absorbed through the mobility of the medium. Thus a fault wherever encountered is to be regarded as a more or less elliptical surface of dislocation on which the throw diminishes in all directions from the maximum at the centre. As a consequence of this, when a vein is faulted at the centre of such a surface the strikes coinciding, the portion of it cut by the centre of the fault must be thrown further than the other parts, causing the plane of the vein to be warped above and below the fault with the concavities facing each other. No good example of this has been completely worked out, but in the case of No. 40 fault which cut No. 317 vein in No. 417 drift and stope, there was a striking diminution of throw in both directions from the maximum of 15 ft., the zero points being out of the vein on the level because of the discordance of strike of the two planes.

Thus the faults appear to be distributed throughout the schist in the three dimensions of space as elliptical surfaces of movement, representing the disposition of acute stresses developed during the general compression of the region. They are often connected with veins.

It may be said in concluding, that evidence has been sought, and not found, to support the view that deformation of the veins has in any case bent the quartz without fracturing it, or that bends have been produced in veins subsequent to their formation by any other means than crushing. But judging from the nature of the bends and the character of the crushing of the veins, there has scarcely been any folding or sharp bending in any of them since their formation, the compression of the schist having been more than two thirds completed before the veins were formed.

It may also be said that the plasticity of the schists represented by this one fourth or one third compression since the formation of the veins, appears not to have been universal, having been localized in a way not yet clearly understood; speaking generally, the uneven plasticity, and therefore the irregular deformation of the schists, has resulted in the production of such a variety of structural conditions at different points in the district, that each mine may be assumed to have its own peculiar structural problems, and these can be recognized and solved only by receiving close individual study.

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THE DETERMINATION OF COBALT AND NICKEL IN COBALT METAL

By C. A. Knittel†

The only methods for the analysis of Cobalt Metal which the writer has been able to find in the literature, are given by C. M. Johnson in his book, "Chemical Analysis of Special Steels, Steelmaking Alloys and Graphites." Considerable differences between Steel Works Chemists and the Coniagas Reduction Co. laboratory seem to show the desirability of further information on this subject. The following method has been employed in this laboratory for some time, duplicates checking within 0.02%:

One gram of drillings contained in a 150 c.c. conical flask provided with a trap* (made of a calcium chloride tube) is treated with 20 c.c. of Hydrochloric Acid (S. G. 1.12). A gentle heat is applied until all action ceases. 1 c.c. of nitric acid (S. G. 1.4) is now added to dissolve any remaining metallic residue. As soon as the action of the nitric acid ceases, the trap is rinsed, removed, and the solution evaporated to a syrup. The contents of the flask are taken up with 30 c.c. of water and filtered.

The siliceous residue on the filter is washed with water (acidulated with a few drops of hydrochloric acid), incinerated and fused with five times its weight of potassium pyrosulphate. The fusion is dissolved in a little water, and added to the main filtrate. The slightly acid solution of the metal is warmed and saturated with hydrogen sulphide. The sulphides of arsenic, copper, etc., are removed by filtration, thoroughly washed with acidulated hydrogen sulphide water (1 c.c. HCL : 100 H_2O) and the filtrate caught in a 350. c.c. casserole.

To expel the H_2S, the contents of the casserole are evaporated low, the iron oxidized with a few drops of bromine, 0.2 grams ammonium chloride added, and the evaporation continued to dryness at water bath temperature.

The dry chlorides are taken up in a little water, 0.1 grams of ammonium formate added, and the whole diluted to 50 c.c. The solution is heated until a precipitate of basic formate of iron separates. Very dilute ammonia is now added until the solution is only slightly acid. After further heating for a minute or so, the precipitate of basic iron formate is allowed to settle, filtered and washed with a hot dilute (0.1%) solution of ammonium formate.

The washed iron precipitate is dissolved off the filter with hot dilute (1 : 5) hydrochloric acid, the filtrate caught in the casserole in which the iron precipitation was made. The solution of the iron precipitate is neutralized with ammonia; ammonium formate added, and the iron precipitation repeated in a volume of about 50 c.c.; the precipitate filtered and washed with the hot dilute ammonium formate solution.

The united filtrates from the two iron separations are evaporated with the addition of 8 c.c. concentrated sulphuric acid until fumes of sulphur trioxide are copiously evolved.

The sulphates are taken up in water and transferred to a 180 c.c. tall beaker, keeping the volume of the solution to about 50 c.c. 60 c.c. of ammonia (S. G. 0.9) is now gradually added to the solution in the beaker (kept cool in running water) followed by 10 c.c. of (20%) ammonium bisulphite solution.

The cobalt and nickel are now deposited together with a current of 2.5 amperes. When the solution is colorless, the cover glass and the sides of the beaker are rinsed down with water, and the current reduced to 0.5 amperes, allowed to pass until a few c.c.'s of electrolyte tested with potassium sulphocarbonate show that the cobalt and nickel are completely deposited. The cathode is removed with the usual precaution, dried, and the deposited cobalt and nickel weighed.

The cobalt and nickel are dissolved off the cathode with 30 c.c.'s of nitric acid (1 : 3), the cathode rinsed, removed, and the solution of the metals boiled to expel nitrous fumes. The solution is diluted to 500 c.c.'s, neutralized with ammonia, made faintly acid with nitric acid, heated to about 50-60°C and the nickel precipitated with 30 c.c.'s of a 1% alcoholic solution of dimethylglyoxim, followed by 10c.c. of 20% ammonium acetate solution.

The precipitate is allowed to stand for four hours, filtered on asbestos, washed twice with hot water re-dissolved, and the precipitation repeated in a volume of 200 c.c.

After standing for an hour in a warm place, the nickel precipitate is filtered into a Gooch crucible, washed with hot water, and dried at 130-140°C for forty-five minutes. The weight of the precipitate multiplied by 0.20316 equals the nickel, which, subtracted from the cobalt and nickel found by electrolysis, gives the cobalt by difference.

Notes and Precautions.—Cobalt metal as now commonly found in the market contains from 98-98.5% cobalt plus nickel. For this reason the amount of but 0.2-0.3 grams of material recommended by Johnson for the determination of the cobalt and nickel seems scarcely sufficient, as the weighing errors involved would appreciably affect the results. The indiscriminate use of large quantities of acids for solution and oxidation is to be condemned, as the getting rid of the excess only consumes time, and increases the chances of mechanical loss.

In filtering the sulphides of copper, arsenic, etc., and the basic iron, one should choose the size of the filters with due regard to the volume of the precipitate to be filtered. The separation of iron as basic formate is preferred on account of the ease with which it can be washed, and the formates are completely decomposed on evaporation with sulphuric acid.

The presence of acetates in the electrolyte seems to retard the complete decomposition of the last traces of nickel. In one instance on electrolyzing material containing 97.5% cobalt and 0.8% nickel in the presence of acetates, 1 mgr. of nickel was found in the electrolyte 30 minutes after complete deposition of the cobalt. The volume of the elec-

* Gooch—Methods in Chemical Analysis.

†Chemist, The Coniagas Reduction Company, Limited, Deloraine, Ont.

rolyte should be kept within the limit specified above, as the complete deposition of the metals from such dilute solutions as employed by C. M. Johnson, is unnecessarily prolonged. Johnson saturates the electrolyte with hydrogen sulphide after deposition of the metals, and assumes that any precipitates formed consist of cobalt, but this precipitate is very often considerably contaminated with Al. and Mn.

It has been found that the amount of cobalt and nickel remaining in the electrolyte after electrolysis, as conducted in this laboratory, is less than 0.1 mgrm., amounting to less than 0.01% on a one gram sample. Hence the correction used by C. M. Johnson is not employed because its value is doubtful.

The cathodes used are of the preforated type with an effective surface of 90 square cms. The anodes are spirals made of 0.04 inch wire, 5-8 in. diameter, $6\frac{1}{2}$ turns.

MINERAL PRODUCTION OF ONTARIO

The output of the metalliferous mines and works of Ontario for the six months ending 30th June, 1915, as reported to the Ontario Bureau of Mines, is shown by the following table, which gives also the production for the corresponding period of last year:

	1st six months, 1915	1st six months, 1914
Gold	$3,570,072	$2,011,069
Silver	5,188,763	7,063,418
Copper	1,229,894	1,197,059
Nickel	3,393,528	2,872,843
Iron Ore	288,296	118,119
Pig Iron	2,856,040	4,429,664
Cobalt	34,443	22,581
Cobalt oxide (including nickel oxide)	56,812	379,152

Gold.—Of the total yield $3,267,620 came from the mines of Porcupine. The remainder, $302,452, was the combined product of the Canadian Exploration Company at Long Lake, the Tough-Oakes Mines at Kirkland Lake, and the Cordova Mine in Hastings County. The principal Porcupine outputs were Hollinger and Acme $1,764,690, Dome $589,234, Porcupine Crown $382,001, McIntyre $346,997. The production of the Porcupine group is steadily increasing, and the existing scale of operations, if maintained for the full year, will give an increase of about 50 per cent over the yield for 1914.

Promising developments are in progress in other fields. At Kirkland Lake the Tough-Oakes mill is working steadily and satisfactorily, and other prospects there are being opened up. The Huronia Mine in Gauthier township, east of Kirkland lake, is being tested, and more or less work is in progress on the finds at Goodfish lake north of Kirkland lake, also in Boston township. Quartz of remarkable richness has been encountered in the shaft of the Dobie-Leyson claim in the township of Munro. Samples were shown at the recent Canadian National Exhibition, Toronto, carrying up to 2,000 or 2,500 ounces of gold per ton. It is estimated that at least a ton of such ore has so far been obtained, together with a considerable quantity of $40 and $60 ore. Gold has also been found at Howard falls on the Kawashkagama river, corrupted or abbreviated into "Kowkash"—near the crossing of the National Transcontinental railway about 300 miles west of Cochrane. A number of prospectors have gone into the area, and a good many claims have been staked. One of the geologists of the Bureau of Mines is at present on the ground making a preliminary examination of the rocks, but his report has not yet been received.

Silver.—The diminution in the output of silver continues, the falling off as compared with the first six months of 1914 being $1,864,655. Part of the shrinkage is due to the fall in price of silver since the war began, but in any event a decrease was to be expected. The Nipissing mine remains at the head of the producing list, with a yield of $1,139,387, Mining Corporation of Canada (Townsite, Cobalt Lake and City of Cobalt mines) being second with $773,192. Coniagas follows with $565,-816, Kerr Lake, with $410,476. A feature of recent operations in the camp is the development of a rich series of veins by the Mining Corporation of Canada under the townsite of Cobalt. Gowganda yielded $49,126, Miller Lake-O'Brien being the one producing property in that area.

Nickel and Copper.—The output of nickel has never been so great as it is at the present time. Demand is insistent, and producing companies are working their mines and smelters at full capacity. As compared with the corresponding period of 1914 the value of the copper output increased by over 2 per cent., while that of nickel went up by over 18 per cent. The quantity of ore raised was 548,579 tons, and of ore smelted 550,870 tons. The Canadian Copper Company and the Mond Nickel Company are the producing concerns.

Iron Ore and Pig Iron.—The output of iron ore was wholly from the Helen and Magpie mines owned by the Algoma Steel Corporation, and considerably exceeded that of the same period last year. The production of pig iron fell off 38 per cent in value.

Cobalt.—The chief outlet for cobalt oxide—the ceramic works of Europe—has been closed by the war. Consequently the shipments from the silver refineries have been greatly reduced, falling off in value 85 per cent. Some consignments have been made to Great Britain and the United States. Metallic cobalt is now being produced both at Deloro and Thorold, and is finding a use in the manufacture of high grade and high speed tools, also for the plating of metallic objects, replacing nickel for this purpose.

Molybdenite.—There is a strong demand for the ores of molybdenum. The principal one is molybdenite, of which there are many occurrences in Ontario, though so far they have shown the usual pockety and uncertain characteristics which mark deposits of this mineral wherever found. Concentrates carrying 85 or 90 per cent of molybdenum sulphide bring as much as $1.75 per pound. The demand is from steel-makers in England, whose supply before the war came from Germany, mainly as ferro-molybdenum. Nine-tenths of the product is used in making special alloys for ordnance-working tools. Parties in a position to supply molybdenite can be put in touch with buyers by corresponding with the Director of the Imperial Institute, London, Eng.

MINE PUMPING*

By Charles Legrand.

The problem of mine pumping is so much affected by local conditions, and those conditions are so liable to changes during the life of a mine, that the best system to use is difficult to determine. The experience of the writer has been that, in general, for copper mines, electric pumping is most satisfactory unless the quantity of water to be pumped is great or the mine does not use electric power for any other purpose. As a rule, however, figuring on the cost of necessary power plant, the total cost of installation is greater with electric pumps than steam pumps.

As the water is liable to be gritty, outside-packed plunger pumps are to be recommended, and if the water is not acid, or only slightly so, chilled cast-iron plungers pay for their extra cost very quickly in diminished cost of packing. With chilled plungers it is possible to use metallic packing instead of soft packing, if the water is not too gritty nor the lift too high.

In vertical pumps this packing is satisfactory for lifts up to 400 ft., in the experience of the writer, and may be found satisfactory for higher lifts.

For water slightly acid, cement-lined pump bodies have given good satisfaction.

For acid water, both plungers and pump bodies should be made of acid-resisting bronze.

For high lifts, especially with gritty water, a satisfactory pump valve is difficult to find. To reduce the unbalanced pressure on the valve at time of opening it is advisable to have narrow seats; this, however, brings high pressures on the seats when the valve is closed. On large valves for lifts of 600 to 1,000 ft. we have used leather, hard rubber, vulcanized fiber, and soft brass; for clear water the latter has given best satisfaction.

The difficulties due to grit make it advisable to have large sumps where water can settle, and if possible, to have two of them so that they can be cleaned alternately.

At the mines of the Old Dominion Copper Mining & Smelting Co., Globe, it was found that a small air ejector discharging into a mine car is a very convenient way to clean mud and sand from a sump.

Steam Pumps.—The steam pumps can be divided into two broad classes: the direct acting, with simple, compound, or triple-expansion steam cylinders, and fly-wheel pumps with compound or triple-expansion steam cylinders. All the steam pumps are usually run condensing, both for steam economy and because exhaust steam cannot be discharged in the mine.

The steam consumption per water horsepower diminishes in the order given above and the complexity of the pumps increases as the steam consumption diminishes.

The simple direct-acting pump is so uneconomical in steam consumption that it should not be used for permanent pumping although very simple and convenient in emergencies. It can also be used with compressed air instead of steam.

The compound direct-acting pump for small power is a satisfactory pump.

The triple-expansion direct-acting pump is fairly economical in the use of steam if proportions of steam and water ends are correct for the lift. In a great many installations this is not the case and the steam end of the pump is too large for the work done, increasing considerably the steam consumption per horsepower. It is quite usual for mine managers to specify a higher lift for the pump than they expect to have when the pump is installed, so as to enable them to put the pump at a lower level later on.

If a pump has to be ordered for such a change of lift it will be found advantageous to order the pump for the correct lift but specify the water end strong enough to stand the maximum pressure expected in the future. When lift on pump is increased the size of plunger can be altered at small cost to keep the correct proportions between steam and water ends. This naturally decreases the capacity of the pump in proportion to the lift.

All the direct-acting pumps take comparatively little room and are easy to move from level to level.

The compound and triple-expansion fly-wheel pumps are more economical in use of steam, but are much more expensive of installation, require more room, and must be installed on good foundations that will not move or move as a whole. Their use can generally only be justified if the quantity of power to be delivered is considerable, steam expensive, and the probable life of the mine will repay the difference in cost.

Whether a surface condenser or a jet condenser should be used depends on local conditions. The surface condenser has less moving machinery and uses less steam than the jet condenser, but is liable to be out of service a longer time while tubes are being cleaned.

The question of proper size of steam line between boilers and pumps is one which usually is not given sufficient attention, most steam lines being too large for maximum economy. The writer has found in most cases that it is advantageous to have a steam pipe which gives a drop of pressure of 5 to 10 lb. between boilers and pumps, as the reduced condensation pays for the loss of pressure. When a small pipe line is used the usual separator at the pump should be made a separator-receiver, to steady the flow through the pipe line.

All steam pumps have a great advantage where flow is variable, as the speed and delivery of pump are easily adjustable to varying conditions.

Electric Pumps.—The electric pumps can be divided in two broad classes: the plunger and centrifugal pumps.

The plunger pumps are of many designs; the writer generally prefers the vertical type as giving more even wear on packing and plungers and taking less floor space, although they require more head room.

For high lift the quintuplex pump having a practically steady flow on the discharge is advantageous, as it can be used without air chamber.

The motors are generally geared to the pump through a single or double reduction of gears. If straight spur gears are used it is not advisable to have a single reduction of more than 8 to 1, and slow-speed motors have to be used. If herringbone

*A paper to be read at the [illegible] Meeting [illegible] Institute of Mining Engineers [illegible].

gears are used single reduction of larger ratio is permissible, allowing a motor of standard speed for pump drive. The herringbone gear is more efficient than the spur gear, but requires much closer adjustment of pitch line, so that bearings have to be made adjustable to maintain proper distance between pinion and gear shafts. For this style of drive the proper design of bearings is very important.

A flexible coupling between pinion and motor shaft usually pays for itself by reduced maintenance of motor, although on pumps using 50 h.p. or less, a motor with outboard bearing, and either a fabric or raw-hide pinion geared directly to pump without coupling, have been found quite satisfactory.

With alternating-current motors, unless special motors are used, it is necessary to unload the pump at start by means of a bypass valve. Motors with high starting torque can be obtained, but are less efficient than standard motors, and are not necessary unless the pump is to be used with an automatic starter.

Direct-current motors will start the pump under full head, with a starting rheostat made for this service.

The writer has had little experience with centrifugal pumps. As a rule they have the advantages of great simplicity, and ease of connection to motor, having no gearing; they are, however, less efficient than plunger pumps and have to be designed for exactly known conditions. They are sensitive to change of motor speed or changes of head, in a high-lift pump of moderate capacity the passages are small, the water travels at high speed, and if at all gritty the wear upsets the proportions of the pump and quickly affects the efficiency.

With plunger pumps the amount of water delivered can only be altered by varying the speed of the motor, starting and stopping the pump as required by the flow of water, or by passing a portion of the water to the pump suction.

The first method is easy where direct current is available, but more complicated or less efficient where alternating-current motors are used.

The second method can be used with both systems of power, but is hard on the power plant if pumping load is a large proportion of the total.

The third one is inefficient in the use of power, as the pump is working at full load at all times.

As the efficiency of electric pumps is not much affected by their size, where flow of water is variable it is advisable to have more units of a smaller capacity so that the number of units running can be adjusted approximately to the quantity of water pumped and one unit started and stopped by hand or automatically to take care of the variation of water level in the sump.

Electric pumps usually require less attendance than steam pumps and reduce the quantity of heat liberated in the mine, which is a considerable advantage in hot mines.

The electrical measurements are so much easier to make than the steam measurements that an electric pump is likely to be kept at a higher efficiency. With an electric pump it is easy to show the attendants the evil effects of packing the glands too tight and the large amount of power that can be thus consumed without heating the plungers.

The electric plunger pumps can be operated at a lower lift than they are built for with very little loss of efficiency.

Air Lifts.—Where the proper submergence can be obtained an air lift is inexpensive to install and will handle very great quantities of water in a small space, and although the cost of the air is comparatively great, there are practically no other running costs. This method cannot be used from the lowest level of a mine, without a lot of complications, as there is then no way to get the proper submergence.

Air lifts were used at the mine of the Old Dominion Copper Mining & Smelting Co. at Globe in a recent emergency when water flow increased on the upper levels of the mine and got beyond the pumping capacity of the plant. A 10 in. air lift raising the water 200 ft. (exclusive of friction), using air at 90 to 95 lb. pressure at the power plant, required the following amount of air (measured by flow meter) at a barometric pressure of about 27 in. of mercury.

Gallons Water per Minute	Cub. ft. Free Air per Minute	Cub. ft. Free Air per 1,000 gal.
1,011	1,353	1,338
1,680	1,809	1,080
1,794	2,262	1,261
1,925	2,658	1,375
1,965	3,219	1,638

Another lift raising the water 431 ft. exclusive of friction gave the following results:

Gallons Water per minute	Cub ft. Free Air per minute	Cub. ft. Free Air per 1,000 gal.
1,122	3,051	2,718
1,233	3,306—3,395	2,681—2,753
1,233	3,484—3,395	2,825—2,753
1,291	3,832—3,875	2,968—3,002
1,291	3,919—3,875	3,035—3,002
1,325	4,089	3,086

In these tests, which were kept up from 1 to 2 hr. each, the measurements of air were taken with a General Electric Co. air-flow recording meter installed carefully and checked after test according to instructions furnished by the makers; the results are probably correct within 5 per cent.

The measurements on water were obtained by taking the reduction of speed of the pumps when air lift was working and the water level in sump kept constant and a volumetric efficiency of 90 per cent. assumed for the pumps. All pumps were equipped with revolution counters.

The average speed of the pumps was recorded before and after the air test to insure that the water flow had not changed in the mine. The quantities of water are very nearly correct.

The above figures are not given as absolute, but only to give a rough idea of what can be done with an air lift. In both cases the submergence was about 190 ft.

Tests on Steam and Electric Pumps.—In the following table are given the results of some tests on various sizes of steam and electric pumps. These tests were taken under running conditions and for steam pumps the water fed to boilers was taken as used by the pumps, all the auxiliaries of the boiler plant being run from another source of supply.

Tests 1, 2 and 3 were taken by condensing the exhaust of the pump and weighing the condensate and estimating the volumetric efficiency of water end at 90 per cent., as the delivered water was not measured.

Tests 4 to 9 were not taken by the writer.

Tests 10 and 11 are on triple-expansion four-cylinder pumps with two low-pressure cylinders. On these tests steam was superheated 35 deg. when leaving boilers and the pumps were tested together.

Tests 12, 13, and 14 were on pumps immediately after starting.

Test 15 on same pump as No. 14 after two weeks run.

Test 16 is on single-reduction spur-gear pump.

Test 17 is on single-reduction herringbone-gear pump.

Test 18 is the best test on air lift for 200 ft.

Test 19 is the next to the best test on same.

Test 20 is the best test on air lift for 431 ft.

Test 21 is the next to the best test on air lift for 431 ft.

On Tests 18 to 21 the steam consumption per water horsepower-hour is based on air compressors requiring 38 lb. of steam per 1,000 cu. ft. of free air, delivered compressed to 9 lb. gauge pressure.

Steam Pumps

Kind of Pump.	Steam Cylinders Inches	Water Plunger, Inches	Stroke, Inches	Speed Rev. per Min.	Water Del'd During Test, Gal. per Min.	Lift Including Friction, Feet	Steam per Water Horse-power-hour	Boiler Pressure, Pounds
Single Duplex	9	$8\frac{1}{4}$	10	33.0	270	120	98.0	135
Single Duplex	14	$8\frac{1}{2}$	10	33.0	285	111	135.0	135
No. 1 Exhaust in No. 2 as a Compound Pump	....				350	120	78.0	135
Triple Expansion Duplex	10–15½–26	8	24	14.1	278	591	61.5	122
Triple Expansion Duplex	15–23–39	10	24	12.7	391	926	49.4	125
Triple Expansion Duplex	15–23–39	10	24	21.7	658	629	42.1	131
Triple Expansion Duplex	18–28–47	12	24	13.0	584	1,056	35.9	143
Triple Expansion Duplex	18–28–47	12	24	25.7	1,207	1,056	27.8	142
Cross-Compound Fly Wheel	19–35	5–5–8	36	32.4	502	1,059	27.3	110
Triple Expansion Fly Wheel	14–26–26–26	7–5-16	36	38.0	878	652	18.0	137
Triple Expansion Fly Wheel	14–26–26–26	6–3-8	36	32.0	553	883	18.0	137

Electric Pumps

Kind of Pump	Motor, Horse-power	Water Plunger, Inches	Stroke, Inches	Speed Rev. per Min.	Water Delivered During Test, Gal. per Min.	Lift Including Friction, Feet	Steam Based on 25 lb. per Kw-Hr.
Vertical Triplex Double Reduction	10	4	9	36	51	475	32.7
Vertical Triplex Double Reduction	20	4	9	37	54	1,162	28.1
Vertical Triplex Double Reduction	50	9	10	37	302	123	29.1
Vertical Triplex Double Reduction	50	9	10	37	303	123	25.6
Vertical Quintuplex Single Reduction	110	12	12	40	459	1,155	23.1
Horizontal Quintuplex Single Reduction	250	9	18	52	1,215	506	22.2
			Air Lifts			Excluding Friction	
					1,680	200	48.7
					1,794	200	57.5
					1,122	131	57.0
					1,233	131	57.6

The Thomas Davidson Manufacturing Company of Montreal, Canada, have closed a contract for the installation of a Snyder Electric Furnace. The furnace will melt and refine cold steel scrap, producing high grade steel for casting into blanks for the manufacture of shells. This is the second Snyder Furnace to be contracted for to produce steel for use in making war munitions. The other furnace will be installed at Sherbrooke by the Canadian Brakeshoe Company. In view of the stringent requirements with regard to war munitions, it is significant of the development of electric furnaces that they are being installed for this purpose. The Thomas Davidson Manufacturing Company are well known as manufacturers of stamped utensils and as tin and sheet iron metal workers and the cuttings from their stamping department will be used together with scrap available in the district for melting down in the Snyder furnace.

BUREAU OF MINES PUBLICATIONS.

The Ontario Bureau of Mines has issued a list of Publications, including Reports, Maps, and Bulletins (revised to August 1st, 1915), compiled by Mr. W. R. Rogers, topographer.

Many of the earlier reports and maps are now rare, and some copies have been secured by purchase. Such are now offered for sale at a price of one dollar and twenty five cents each for Reports, and ten cents each for Maps, prepaid. Where possible, libraries will be furnished with bound volumes. All the other reports and maps published by the Bureau of Mines are distributed free of charge.

Persons possessing rare volumes of Bureau of Mines' Reports for which they have no further use would oblige the Department by communicating with the Deputy Minister of Mines.

Complete sets of the Reports of the Bureau of Mines are to be found in most of the larger libraries both in Canada and abroad.

NORTH-WESTERN PLACER-GOLD FIELDS

The British Columbia Correspondent of the Canadian Mining Journal writes that, in his opinion, there is much truth in the following communication to one of the daily newspapers published in Victoria, B.C., and since a similar plea might well be made for placer-gold regions in other parts of the Dominion than the Northwest, he suggests that the information contained in the letter, which was headed "Northern Gold-bearing Area," and was signed "Sourdough," will probably be read with interest by others than residents in British Columbia, if reprinted in the Journal. The letter follows:

Among the many remedies advanced towards alleviating the present financial stringency throughout British Columbia too little attention has been turned to the opportunities offered by the exploitation of the placer grounds of the province.

The fields now being rendered more accessible by railways under construction are undoubtedly helping to direct attention to a source of wealth that has for many years lain practically dormant, but the possibilities of placer gold being made to play a large part in our prosperity, does not seem to have yet engaged the consideration of the general public as it is entitled to do.

The falling off of the yield of placer gold in the province is owing to lack of new discoveries, exhaustion of known fields, difficulties of transportation, and the opportunities that have been offered during the past years in making money in real estate.

The foremost factor in the falling off of the yield of placer gold lies fundamentally with changing conditions; just as surely as the old-time pioneer, braving the hardships of the wilderness to found a home on the far fringe of civilization has passed away, so too has the old-time prospector, hence the millions of acres of unprospected ground in the province today, lying for the most part beyond the reach of only the most venturesome. Those regions, were they rendered more accessible, would bring into being a new race of prospectors, and who can say that their rewards would not be similar to those of the men of '49, '62, and '97.

Within the area lying between northern British Columbia and Yukon Territory lie hundreds of miles of unexplored regions that are known to be gold-bearing. There is room for a dozen Klondykes there, and every possibility of finding paying fields once the barrier of transportation difficulties is removed.

Warburton Pike, an authority whose knowledge of this territory is unquestioned, wrote as follows as far back as twenty years ago: "If a man carefully examines a map of the northern territories he will see that there is an enormous stretch of country bounded by the Yukon on the west, the main range of Rockies on the east, and the Liard on the south, over which the white man's foot has never trodden, and yet it is the birthplace of large streams that give every promise of wealth. The Pelly, the Ross, the McMillan, and the Stewart, with the Yukon from the east all have their sources in this district, while south of the unkown divide, the Francis, Hyland, Black and Beaver rivers drain large areas toward the Liard. All these streams have been proved to bear gold at their mouths, but the exploration of their upper waters has always proved a task beyond the power of the poor prospector. South of the Liard again lies another little-known area, embracing the Omineca and Peace River districts. All this country lies in the mineral belt extending northward from California, and has proved wherever examined to be rich in precious metals. What bigger field for enterprise could be opened for any colony?

"Of all the unexplored region left on the earth's surface there is none that offers a more enticing field for exploration or more promise of practical reward to the enterprising traveler than the country drained by the tributaries of the Yukon and Mackenzie. It is a land with a great future, clear of native troubles or political complications, and British Columbians have only themselves to blame if they fail to take advantage of the possibilities placed ready to their hands."

The above, written nearly twenty years ago, is as true of today as it was then. The country is still unknown, the prospector is still handicapped by the difficulties of transportation; the gold is there; let means of access be provided and this rich territory be rendered capable of yielding up its treasures.

There is a lamentable want of knowledge in regard to the potentialities of northern British Columbia and at the same time a wilful disregard of the possibilities of this great area, because it lies so far from the direct spheres of influence of the present centres of population. Anything directly tending to the further upbuilding of those centres would be eagerly considered when advantages to the province as a whole would be ignored.

These are hard words to say, but if we are ever going to make real progress in British Columbia they cannot be lost sight of.

A broader minded policy is badly needed, as well as a greater knowledge of the assets of the province. The government has done much to assist in many ways the furtherance of this knowledge, but much remains yet to be done. The blame lies at the door of the people themselves, who by their apathy in regard to everything except what they are personally interested in have retarded the advancement of the province as a whole.

Suppose the railway from Vancouver to Fort George had been built, say from a point on the Grand Trunk Pacific Railway to the north, it would have formed a long link in the chain of railways that will ultimately connect Alaska with this province; but a proposition such as this would have been negatived at once by the people because it would not have directly benefited their interests so far as they could see, owing to their want of knowledge of real conditions and a lack of perception of the advantages to be gained to the province as a whole.

Similar ignorance to that displayed regarding the Northwest only a very few years ago is still in evidence as far as northern British Columbia is concerned, and the sooner the true conditions in regard to it are made known the sooner will the whole province reap the benefit.

The placer mining laws have remained on the statute books practically unaltered for many years. No one can gainsay that they have been as nearly perfect as it was possible to make them, but laws must change with conditions, and if a revival of the placer mining industry is to be desired, then freer and more elastic mining laws are required. If the laws in regard to quartz claims were applied to placer claims, a grubstaker would have some pro-

tection. At the present time all he has is an interest in a placer claim that may be staked. His interest ceases if the claim lies unworked for a period of seventy-two hours during the open season, and without the grubstaker no very great increase in the number of prospectors may be looked for. We know that any effort to change the placer mining laws will meet with opposition, mostly from the man who never washed a pan of gold in his life nor put a dollar into a proposition to help someone to do so. The question is an open one, but if the placer mining is to be revived stumbling blocks must be removed, whether they are laws, lack of knowledge, of transportation, or whatever stands in the way.

We do know that there is gold in British Columbia, but we have been too busy diverting the golden stream from the coffers of the investor that has flowed so steadily for many years to consider the unminted wealth that lies almost to our hand; wealth every dollar of which is a dollar gained, even the interest on which remains in the province.

No one can deny but what the hard times we have passed through have taught us a lesson. We are still learning it today and its first-fruits are a renewed interest in the development of our natural resources. Agriculture, timber, and fisheries are being considered as they never were before, also lode-mining, in so far as our limited means will allow, but placer-mining has yet to again come into its own.

Individual efforts can accomplish a lot, but united efforts can do more. We want more knowledge of our virgin fields, easier means of reaching them, and if such is shown to be needed, better laws for working them.

INTERNATIONAL NICKEL CO.

The International Nickel Co., the common stock of which (there is $38,000,000 common and $9,000,000 preferred) has just climbed above $200 a share has become a most prosperous mining-manufacturing corporation, not so much on account of the European war as by reason of its domination of the world's nickel market. Yet it cannot be classed as a "trust." Its good fortune rather lies in the fact that it owns and operates the largest and richest nickel deposit in the world.

The Boston News Bureau back in August, 1906, gave the first detailed account of the company's operations, as annual reports did not convey much information. At that time the common sold at $110 although it had been as high as $140. It paid no dividends however. Gross values below ground were then estimated at $450,000,000, which consisted of 15,000,000 tons of ore averaging $30 per ton.

Gross values, say the management, have since been increased as follows:

17,000,000 tons $30 ore	$510,000,000
30,000,000 tons $15 ore	450,000,000
Total	960,000,000

This tonnage indicates 60 years of life in reserve at present rate of extraction.

The company has never leaned strongly to the side of publicity, and stockholders, now receiving at the rate of 20 per cent on their common stock, say the management, "have been treated too liberally to persist in seeking information." With the listing of the shares on the New York Stock Exchange more will be known.

Sudbury, Ontario, is the home of the wonderful deposits of the International Nickel Co. The ores run high in nickel and copper. They also contain other by-products including gold and platinum. Copper production has been running about 3,000,000 pounds a month, which under current high prices has also been adding materially to treasury receipts.

Despite the new demand that has sprung up for nickel the International Co. has not advanced prices. Formerly it shipped large quantities of nickel to Germany but this outlet was cut off with the outbreak of the war. The product has been fully cared for, however, by means of the growth in demand from other quarters.

Earnings have been running at the rate of about 32 per cent per annum against 20 per cent paid in dividends. A substantial surplus has been accumulated, it being estimated at $8,000,000. As the company conducts a cash business it does not need a large working capital, so that outlook for either an increased or extra cash dividend or another stock distribution appears to be very favorable.—Boston News Bureau.

BEAVER CONSOLIDATED MINES LIMITED.

The directors of the Beaver Consolidated Mines, Limited, report for the quarter ending August 31st, 1915:

Drifting, 876.5 ft.; Crosscutting, 303.5 ft.; Sinking, 151.5 ft.; Raising, 268.5 ft.; Stoping, 1,133.5 cubic yds.

The main shaft is down to a depth of about 1,100 ft. As stated in previous reports, the directors deem it advisable to continue sinking the shaft until the lower contact between the Diabase and Keewatin formations is reached. "During the months of June and July, we encountered some loose ground in the shaft which retarded our work very materially, but the record of sinking for August has been very satisfactory. The price of silver has been so low for the last few months that we did not consider it good business to raise the ore and convert it into bullion on which storage and other charges have to be paid; consequently, we have kept the drills working mostly on development. There is a great deal of ground yet to be prospected on the upper levels of the property, and, recently, on the 300 ft. level, in driving on a small vein from one of the main drifts, we encountered a body of ore which looks very promising both as to high-grade and mill rock. The physical condition of the mine is excellent. The addition to the mill has been completed with the exception of the lining for one of the ball mills. This has not arrived yet, although it has been on order for three months. As soon as it reaches the property and is installed, the daily capacity of the mill will be increased to 150 tons."

From the following statement, it will be seen that the company had quite an amount of bullion in storage in New York on August 31st.

Bullion in storage in New York	235,075.54 oz
Bullion due from Smelters	22,801.88 oz
Ore bagged at Mine	56,634.00 oz
Total	314,511.42 oz
Cash on hand	$110,097.25

PERSONAL AND GENERAL

Over 600 undergraduate students enlisted from the University of Toronto alone, last year's senior champion Rugby team sending 17 men out of 23, and the three championship hockey teams sent 18 out of 24.

The prospective retirement from the Government of Hon. Louis Coderre, Secretary of State and Minister of Mines is again being discussed. It is known that Mr. Coderre is desirous of leaving political life, and there seems to be a strong probability of his appointment in the near future to one of the vacant judgeships in Quebec Province.

A cheque for the sum of $10,000 has been received by His Honor Judge Kehoe, President of the Sudbury Branch of the Canadian Patriotic Fund, from the Mond Nickel Company, Coniston, as a donation to the Fund.

Mr. J. Murray Riddell, of Iron River, Mich., was in Toronto during September on his honeymoon.

Mr. C. W. Wright has returned to Sardinia.

Dr. T. O. Bosworth, of London, is investigating petroleum resources of the Peace River district, Alberta.

Mr. Robt. Bryce, after a brief stay in Toronto, has returned to the Western United States.

Mr. W. F. Ferrier left Toronto for the West on Sept. 17. He expects to be away for several weeks.

Mr. J. B. Tyrrell has returned to Toronto after visiting the Kowkash district.

Mr. C. F. Schaber has been appointed division engineer for the Tennessee Coal, Iron and Railway Co.

Dr. Thomas H. Norton, commercial agent of U. S. department of commerce, announces discovery by a government chemist of a new and seemingly practicable method for extraction of potassium carbonate from feldspar. Should it prove a success, it will give to America a practically unlimited supply of potash.

Dr. Frank D. Adams, of Montreal, has been in the West. According to a published press despatch, he and Mr. W. J. Dick, mining engineer to the Conservation Commission of Canada, have been investigating "deposits of phosphate of lime in the Banff National Park in the Rocky Mountains."

Mr. H. Foster Bain, formerly editor of Mining and Scientific Press, San Francisco, but now editing The Mining Magazine, London, England, had his name freely mentioned for the position of Director of the United States Bureau of Mines. Immediately he learned that his friends were working in his interests, he cabled to Mr. T. A. Rickard, now editor of Mining and Scientific Press that he would not be a candidate for the appointment, but that he supported Mr. H. Van Manning, who had long been the friend and assistant of the late Director, Dr. Joseph A. Holmes. Mr. Manning's appointment as Director has since been made and announced.

Mr. Howland Bancroft, of Denver, Colorado, has gone to Bolivia, for which country he left New Orleans on August 11

Mr. Lorne A. Campbell, M.L.A. in British Columbia for the constituency of Rossland, and general manager of the West Kootenay Power and Light Co., has returned to Rossland from a trip to Ontario, where his father was very ill. Mr. Campbell, Sen. died shortly after his son's arrival at home.

Mr. M. S. Davys, of Silverton, Slocan Lake, B.C., managing director of the Silverton Mines, Ltd., operating the Hewitt-Lorna Doone group of silver-zinc mines and concentrating mill in Silverton camp, has returned to British Columbia from a business trip to New York. The Minerals Separation flotation process has been successfully adopted at the Silverton Mines company's plant.

Mr. Geo. Watkin Evans, of Seattle, Washington, a coal mining engineer who two or three years ago gave much attention to the coal measures of the Groundhog basin, in the upper Skeena district of British Columbia, and afterward superintended the mining of about 1000 tons of coal in the Matanuska field, Alaska, for U. S. Navy to test, is again in that country investigating mining conditions and property.

Mr. Colin Fraser, formerly on the staff of the Geological Survey of New Zealand and a much-valued assistant to Dr. J. McIntosh Bell when the latter was Director of the Survey of that country, has been making a geological examination of the famous Mt. Morgan mine in Queensland, Australia. Several years ago Mr. Fraser spent some time in Canada looking over mining properties, both in Ontario and British Columbia, in the interests of capitalists resident in England.

Mr. H. W. Hardinge, of New York City, president of the Hardinge Conical Mill Co., after a trip through the chief mining districts of northern Ontario, returned to New York, and later proceeded to San Francisco to there attend the meeting of the American Institute of Mining Engineers.

Mr. J. P. Keane, who for some years was manager of the Cariboo-McKinney mine and mill in Camp McKinney, British Columbia, during the dividend-paying days of that gold property, and later engaged in developing the Wonderful silver-lead mine, near Sandon, Slocan, B.C., was in Victoria recently, endeavoring to make arrangements to lease or purchase a concentrating mill in the Slocan, so that he and his associates might resume the custom ore-concentrating business they had successfully established at Sandon, Slocan, but which has been interrupted by the burning of the Ivanhoe mill they were working under lease until its destruction on August 30th.

Mr. J. S. Kimball, of San Francisco, California, several weeks since examined the Valdes Copper Co's Copper Mountain group of mineral claims situated on Quadra island, on the east side of Discovery passage, between the Mainland of British Columbia and Vancouver island. A description of this property, by Mr. J. W. Astley, of Toronto, was printed in the 1914 Report of the Minister of Mines for British Columbia.

Mr. Anthony J. McMillan, official liquidator of the Le Roi Mining Co., who has been at Northport, Washington, in connection with negotiations for the sale of the company's smelting works there to mine owners operating in the Coeur d'Alene district of Idaho, has been spending a few days in Victoria, B.C. The Northport smeltery is being prepared to smelt lead as well as copper ore.

Mr. G. W. Ottreson, manager of the Kildare Mines, Ltd., an eastern Canadian company engaged in the exploration of placer-gold property on Slate Creek, Omineca, British Columbia, on which stream are situated the placer claims covered by the fourteen leases held by the company, has finished his work in the field for the 1915 season and was at his home in Seattle early in September.

Mr. Stuart J. Schofield, of Ottawa, is continuing his geological examination of country east of Kootenay Lake, in British Columbia, for a report thereon to the Director of the Geological Survey of Canada.

Professor Francis A. Thomson, head of the department of mining engineering of the State College of Washington, and Professor F. M. Handy, assistant professor of economic geology for the same department, have returned to their college duties at Pullman, Washington. During the summer Professor Thomson spent several weeks in West Kootenay, B.C., and afterward visited the Panama-Pacific International Exposition, while Professor Handy was occupied in investigating the geology of the Similkameen country about Oroville, near the International Boundary line.

Mr. Walter Harvey Weed, of New York City, has returned to the United States from Newfoundland, where he had been doing professional work.

Mr. Fred R. Weekes, who during one season superintended the work of developing a number of mineral claims on Copper mountain, near Princeton, in the Similkameen district of British Columbia, for the British Columbia Copper Company and allied interests, has removed to Darwin, California, from New York city.

Mr. Clyde White has returned to Sandon, Slocan, B.C., from the Portland Canal mining division of British Columbia, where he had for some time been engaged in directing development work on one of the chief mining properties of that part of the province.

Messrs. Bruce and Oscar V. White were in Spokane early in September, where they attended the funeral of their brother, the late Byron N. White. They have since returned to Slocan, B.C., where the former is part owner and in charge of the Noonday mine, and the latter superintendent of the Slocan Star mine and concentrating mill.

OBITUARY.

On Saturday night, September 11, Byron Noel White died at Spokane, Washington. The "Spokesman-Review," of Spokane, published the following obituary notice:

"Byron N. White, who has been prominently identified with the mining industry of the Northwest for the last quarter of a century, died of paralysis at the family home, Spokane, early last night. He was the father of Prosecuting Attorney John B. White, of this city.

"Mr. White's illness dates back three years and he had been seriously ill for the last eighteen months, when he suffered a stroke of paralysis. Since that time he was confined to his home. On September 1 he suffered the third stroke and was in a state of coma thereafter.

"Mr. White was born in St. Thomas, Ontario, 65 years ago and came to Spokane about a quarter of a century ago from Ontonogan, Michigan, where he was engaged in iron and copper mining. He was one of the original owners of the celebrated White Pine mine, which has recently become an important copper producer.

"Upon arriving at Spokane, Mr. White engaged in mining, with which he continued to be connected until he was taken ill. He was one of the original owners of the Slocan Star mine, in British Columbia, and at the time of his death he was still largely interested in that property. He was also interested in the Pueblo mine, in Whitehorse copper camp, southern Yukon Territory, and, as well, in mining properties in Oregon. Beside, he operated in Mexico for a time.

"Mr. White was married in 1884 to Miss Sarah Blackwood, at Chatham, Ontario. Prosecuting Attorney White is their only child. Two brothers, Bruce and Oscar V. White, both of Sandon, Slocan, B. C., and two sisters, Mrs. Charles Culver, of Seattle, and Mrs. T. Sharp, of Spokane, survive."

It may be added that Mr. White's chief mining activities for a number of years were in connection with the development and productive operation of the Slocan Star mine, situated near Sandon, British Columbia. To acquire the Slocan Star group, which eventually comprised about a dozen mineral claims, in 1892 the Byron N. White company was incorporated as an extra-provincial company, under the laws of Wisconsin, U. S. A., with an authorized capital of $500,000. Its directors were: Byron N. White, Spokane, president and general manager; J. Hoyt Smith, Milwaukee, vice-president; J. W. Dadmun, Milwaukee, secretary-treasurer; and David Vance and Frank L. Vance, both of Milwaukee. Oscar V. White, of Sandon, B.C., was mine superintendent, which position he still occupies. A published statement of "total gross shipments" during a period of twelve years, 1894-1905, both inclusive, shows the following gross value: Shipments of ore, $1,291,728; of silver-lead concentrate, $1,229,641; of zinc concentrate, $154,061; total, $2,675,430. The total of dividends paid by the company during that period was $542,600. Protracted and costly litigation between the Star Mining and Milling Co. as plaintiffs, and the Byron N. White Co. as defendants, during a period of about ten years, was finally determined by a judgment of the Supreme Court of Canada, leave to appeal from which was refused by the Privy Council in England in the year 1909. The cause of this litigation was a trespass by the defendant company in following the dip of the Slocan Star vein and the extraction of the ore from the property of the plaintiff company; the defendants asserting that they were entitled to do this by reason of the existence of the apex of the vein upon the surface of their mineral claims, which had been located at a time when the mining laws of British Columbia granted to the locator what are known as "extra-lateral rights." This litigation was a source of great anxiety and vexation to Mr. White, who to its conclusion maintained that his company was in the right. However, the final decision of the courts was against him, and later, in 1911, a merger was arranged and the Slocan Star Mines, Ltd., organized to acquire and operate both properties concerned, with Mr. Byron White as one of the directors and Mr. Oscar White as mine superintendent, since which time the property has been extensively further developed.

Sir Richard McBride, Premier and Minister of Mines for British Columbia, when informed of the death of Mr. White, said to a representative of the Victoria "Daily Colonist": "I regret exceedingly the death

of Mr. White, whom I knew intimately for many years. No man ever did more for the mining industry of British Columbia than he, judged from the standpoint of personal efforts. Not only did he invest large sums of his own money in mining properties in this Province, but he induced other capitalists to come over to our side of the International Boundary line and take an interest in the development of the country. He had the greatest faith in the future of British Columbia as a mineral-producing country. His loss will be greatly felt."

Mr. R. F. Green, M.P. for the Kootenay district in the Federal House of Commons, said: "British Columbia has suffered a real loss in the death of Mr. Byron White. I knew him intimately and was aware of many plans he had afoot looking to the further development of mining properties in this country. He was always an optimist in regard to the future of British Columbia, and I know that he was personally responsible for the introduction of large sums of capital. It was his prediction that British Columbia is destined to become one of the greatest mineral-producing countries in the world, and he never hesitated to back his judgment with his money. The development of the Slocan district was largely the result of his initiative, while in recent years he had also been paying attention to Southern Yukon, where he was largely interested in the development of a copper property."

Prof. C. E. Hayden, a mining engineer of Bellingham, Washington, was accidentally killed on Sunday afternoon, August 29, on a trail about 20 miles north of Harrison lake, British Columbia, when a shotgun carried by J. B. Ellinger, a member of the party, was accidentally discharged, the loads of both barrels entering Mr. Hayden's side. Death was instantaneous. The party was returning on horseback from a visit to a mining property, when Mr. Hayden attempted to pass Mr. Ellinger on the rather narrow trail, with the result that the hammers of the double-barreled gun which Mr. Ellinger was carrying across his saddle, caught in the horn of the saddle, causing the discharge of both barrels and the death of Mr. Hayden.

DIVIDENDS FROM BRITISH COLUMBIA MINES.

Last month the **Standard Silver-Lead Mining Co., Ltd.,** operating a silver-lead-zinc mine and a concentrating mill near Silverton, Slocan Lake, British Columbia, paid a dividend of 2½ cents a share on its 2,000,000 shares. The total of this profit disbursement, which was made on September 10, was $60,000. It is stated that the company's net profits for the month of July were $85,000. Owing to a suspension of ore production in August, 1914, consequent on the outbreak of war, no dividend had been declared since September, 1914. Prior to that month, however, there had been for more than two years a monthly dividend-payment of $50,000, with an occasional extra dividend of a like total.

The Consolidated Mining and Smelting Company of Canada, Ltd., operating mines at Rossland, in the Slocan district, and in East Kootenay, respectively, and the copper and lead-smelting works and lead-refinery at Trail, has declared its Dividend No. 18, of two per cent. for the quarter ending September 30, payable October 1; total for the quarter, at $2 a share, $116,098. This company makes its quarterly dividend payments at the rate of 8 per cent. per annum.

The Granby Consolidated Mining, Smelting, and Power Co's dividend for the current quarter, at the rate of $1.50 a share on its issued shares will total about $224,975. In its issue of September 11th the Boston Commercial said: "While it is quite possible that the directors may not increase the Granby Co's quarterly dividend beyond $1.50 a share when they meet this month, it seems reasonably certain that stockholders will receive a large extra in December or January." Elsewhere in this number of the Journal appears a brief statement of the company's smelting operations, made by the general manager when he was in Spokane, Washington, last month.

The Hedley Gold Mining Co., operating the Nickel Plate-Sunnyside group of gold mines and a 40-stamp mill and cyanide plant in Camp Hedley, Similkameen, at the end of September paid its customary five per cent. on its issued capital of $1,200,000, or a total for the quarter of $60,000. It is the rule of this company to pay a similar amount at the close of each of three quarters of each year, and then at the end of the fourth quarter make a larger distribution. Last year, owing to war conditions the directors deemed it wise to maintain a cash surplus in hand of at least $100,000, consequently the dividend for the final quarter was ten per cent., making the year's total of dividend disbursements to shareholders $300,000, instead of 15 per cent. for the last quarter with a total of $360,000 for the year, as had been paid in both 1913 and 1912. When the company's general superintendent was in Victoria a few weeks ago he stated that so much ore of good grade had been opened in the mine that this year's total of dividends may confidently be expected to be similar to those of 1913 and 1912.

J. M. TURNBULL TO BE PROFESSOR OF MINING.

It is reported from Vancouver that among other appointments made recently to the Faculty of the University of British Columbia, was that of Mr. Turnbull, of Trail, to be professor of mining.

Mr. John Moncrieff Turnbull, who for years has been on the mining engineering staff of the Consolidated Mining & Smelting Company of Canada, Limited, graduated from McGill University, Montreal, Quebec, in 1897, as bachelor of applied science, with the first rank honors in natural science. During the comparatively long peroid he has been engaged in mining engineering with the Consolidated Company he has had a close and an extensive experience with the productive mining industry of British Columbia, beside which in his capacity of examining engineer he has traveled throughout the various districts of the Province and has examined many mines and mineral claims, so that he has acquired much valuable information relative to its mineral resources, both developed and potential.

The appointment would, therefore, appear to be an eminently wise one, for mining students are likely to derive much benefit from one so well qualified to give accurate information concerning mineral occurrences and metalliferous mining methods in British Columbia.

SPECIAL CORRESPONDENCE

PORCUPINE, MUNRO TOWNSHIP, KIRKLAND LAKE AND KOWKASH

Kowkash.—The rush into Kowkash followed the usual course of all stampedes. They usually break out in the fall because the prospectors have been able to work since the early summer and have had a good opportunity to make finds and to stake their discoveries. The news filtered out and the rush commenced. Those who arrived in the stampede found that no work had been done in the country and that it had never been prospected before with the exception of the little trenching that had been done on the original discovery. They swarmed over the country and tied on to the Dodds' claims, placing out their four corner posts without the least attempt to make discovery. Then those who had merely gone in to stake with a view of instant sale came out and proceeded to say that the country was all swamp and did not hold very good prospects. The prospectors who are in the business all the year round or who were well backed are staying in the bush and doing all the work they can in the next two months before the snow falls. The one discovery to date is on one of the three claims held by E. King Dodds, a prospector who has been working along the T. C. R., since the early spring. The vein is four inches wide of very remarkable ore indeed and this particular shoot is about fourteen ft. long. The formation is chloritic schist and quartz porphyry as far as yet can be ascertained. The Ontario Geological Survey with commendable promptitude sent in Mr. P. E. Hopkins who is now at work collecting information for a hastily revised Geological map for the use of prospectors. This will be compiled and rushed out with the greatest possible speed. The department of Lands, Forests and Mines also ordered Mr. T. A. McArthur to go into Kowkash and decide for them whether it would be desirable to establish a Mining Recorder's office right at headquarters. A more easy camp to reach, it is hard to imagine. Taking the National out of Toronto at eleven o'clock one night it is possible to take the pullman to Kowkash and leave it at two o'clock the morning after next. At the point where the prospectors are leaving the railway, Johnson Creek, two shacks have already been erected, but there is no station until Kowkash is reached a mile and a half east; here the T. C. R. has placed an operator. From Johnson Creek the paddle to the Dodds' claims is not much more than twenty miles; across country it would not exceed ten miles. Johnson Creek is a tributary of the Kowkash River and the Kowkash River flows into the Albany River. The scene of excitement is very close to the height of land at this point, the waters of course running north. There are no rapids which cannot easily be run until Howard Falls is reached. Howard Falls is a height of about fifteen ft. and application has already been made to the department of Lands, Forests and Mines, for the right to develop it in case the camp becomes a producing one. The Dodds find is about a mile and a half beyond Howard Falls. The country is singularly like Porcupine in its topographical features. On first sight it appears to be merely swamp but a little careful scrutiny will show many regular outcrops probably covered with moss. This can be easily prospected and many of the claims staked have at least rock upon them, although no one stayed to make the discovery which is necessary in the Mining Act. While nothing as yet has been proved beyond the existence of very rich quartz in a narrow and short shoot of ore there is a disposition to regard the new field as very promising. There are already rumors of further strikes, but these latter have not at this date been corroborated.

Further inducement to visit Kowkash is the remarkable speckled trout fishing to be found in the waters of nearly all the streams in this section of the country. The easiness of the trip tempted many business men who had no intention of staking to make the trip into Kowkash. Many of the old prospectors who have been earning a regular wage in the various mines of the North for the past two or three years threw up their jobs in order to again take to the bush.

The Schumacher Mill is now treating ore. The plant commenced operations on the first of September and it is now treating from 75 to 85 tons a day. It is expected that there would be no difficulty in gradually raising the capacity to 150 tons a day. The mill is running very smoothly and Mr. Houston has had very little difficulty with it.

Hollinger.—The last monthly report of the Hollinger showed that a sweeping cut had been made in milling costs. The mill costs for the 28 days ending August 12th only amounted to $9.84 per ton. This was on a tonnage of 28,358. For the period ending July 15th, the milling costs were $1.067 and for the period ending June 17th the milling costs were $1.106 per ton, thus showing a very substantial decrease in the milling costs per ton. The mining costs were also down a little and the grade was slightly lower, being $9.03 per ton, against $9.26 for the corresponding period. Of the 28,358 tons treated 2,640 came from development and 25,182 from stopes. There is as yet only a few tons of ore being stoped below the 525 ft. level. The mill ran 96.17 per cent. of the possible running time, treating 39,955 tons of which 28,358 tons was Hollinger ore and 11,597 tons Acme Gold Mines ore

COBALT, GOWGANDA AND SOUTH LORRAIN

Nipissing.—According to a paragraph in the last monthly report of the Nipissing there is a possibility that the extension of the vein found on the Cobalt Lake fault will be picked up on the Nipissing at depth. The ore recently found at the south end of Cobalt Lake on the fault is so rich that its development is of considerable importance to the Nipissing. The ore body where it has been developed is not far from the Nipissing boundary and it is dipping towards it. The paragraph reads: "Recent developments on the Cobalt Lake fault by an adjoining company have been favorable and it is possible it will enter Nipissing ground at depth. Any development of the fault in Nipissing ground will have to be left until this possibility has been definitely determined."

For the first time in many years the amount of

ore mined at the Nipissing exceeded that of customs and Nipissing ore shipped. The amount mined differs only $900 from the July output but the shipments showed a drop from 262,616 to 118,047. The figures for the past three months are:

	Ore Mined.	Nipissing and Customs Bullion Shipped.
June	175,552	$376,486
July	179,998	262,616
August	179,048	118,047

A very extensive scheme of increased development has been mapped out; this includes cross cutting from the Meyer in many directions. One of these cross cuts will be run from the first level of the Meyer to pick up small but rich veins showing signs on the first level or on the surface. Other exploration is in favorable ground between the Meyer and 80. From the tunnel level of vein 96 on the Little Nipissing hill a cross cut is being run into new territory to discover what lies beneath certain well defined fissures found on the surface An arrangement has been made between the O'Brien Mining Company and the Nipissing Mining Company whereby the Nipissing will commence exploration work from No. 14 shaft on the O'Brien. This shaft was sunk some years ago about 100 ft. from the Nipissing claim 402. A cross cut was run almost to the boundary between the two properties. Cross cutting will commence east and west from this point near the boundary in order to discover if there are any profitable ore bodies in the vicinity. The formation is partly in the conglomerate and partly in the diabase.

The Shamrock Mine has now been dewatered and a cross cut has been started south on the 400 ft. level. It will be pushed to within 30 ft. of the Beaver line, when cross cutting will commence east and west parallel to the line with the intention of picking up extensions of Beaver veins.

The Right of Way Mining Company is still obtaining very good results from its operations at the south shaft. Recently an extension of a high grade vein has been picked up and it is quite possible that it will produce considerable ore.

The Silver Queen lease which is now in the hands of Mr. Stuart Thorne is also doing quite well.

BRITISH COLUMBIA

Generally, reports from the various metalliferous mining districts of the Province continue to indicate progress, with production being well kept up. For instance, the total quantity of ore received at the Consolidated Mining and Smelting Co's smeltery at Trail during four weeks ended September 9, was 37,527 tons, an average of 9,382 tons a week. This compares with 32,107 tons for four weeks ended August 12, an average of 8,027 tons a week. The total of ore receipts at Trail for the 36 weeks of 1915, to September 9, inclusive, is 305,700, an average of 8,492 tons a week.

It is noteworthy that several small mines that had not been on the list of producers for some time recently made small shipments of ore to Trail. Among these are the Ottawa, in Slocan City division of West Kootenay; the Rio, and the Buffalo, in Slocan division; the Sally, in Boundary district; the Sunrise and Silver Cup, near Hazelton, in Omineca division; the Copper King group, in Nicola district; and the Monarch, near Field on the C.P.R. mainline railway.

The progress of the negotiations toward the establishment of zinc production in the Province has attracted attention, particularly in West Kootenay district, and it is hoped that practical results will be the outcome.

West Kootenay.

Ainsworth.—Shipment of concentrate from the Bluebell mine, on the eastern shore of Kootenay lake, opposite the town of Ainsworth, has been resumed after a year of non-productiveness, the result of the European war. About 200 tons of concentrate from that mine reached Nelson on August 12, in transit to the smeltery at Trail. The wagon road from Ainsworth to the Skyline mine, owned by Mr. A. W. McCune, of Salt Lake City, Utah, has been cleared and repaired; it is understood that this is preparatory to work being resumed on the Skyline, which has long been unworked. Wagon-road connection between the Florence Mining Co's property and the Highland concentrating mill is being provided, so that ore from the Florence mine may be hauled to the mill. It is expected that the production of ore at the Cork-Province mine will be maintained and shipments to Trail be continued as long as there shall be water available for operating the Cork concentrating mill. Higher up the Kaslo & Slocan railway is situated the shipping place for the Utica mine, on Paddy's mountain, from which it is intended to ship ore in larger quantity than has been practicable in the past. A promising shoot of ore has been opened on the Marten group, on the south fork of Kaslo creek and ore is being packed out for shipment.

Slocan.—News items from the New Denver "Slocan Record" are as follows: The aerial tramway of the Ruth-Hope, near Sandon, was started about the end of August. W. J. McMillan, of the Alps mine, north fork of Carpenter Creek, has lost two of his packhorses, which slipped from the trail and fell over a bluff. Silver ore is being packed down from the Mountain Con mine to the railway at Sandon. A telephone has been put in at the Galena Farm mine, south of Silverton, the adit is being advanced about 200 ft. a month at this mine. Mr. J. P. Keane, who was one of the lessees of the Ivanhoe mill, went to Victoria early in September to endeavour to make arrangements for leasing or purchasing the concentrator near Rosebery. Development of the Echo property, above the Standard mine, is reported to be satisfactory; lately the drift has passed through concentrating ore, with occasional stringers of clean ore up to five inches in width. About 40 tons of ore has been shipped from the Wakefield mine, high above Four-mile creek; the ore runs 130 oz. silver to the ton and 40 per cent lead. Work has been discontinued there for the winter. Development work has been resumed in the No. 8 crosscut adit of the Standard mine. Snow fell on the tops of mountains in the district that are 6,000 to 7,000 ft. high. A shipment of 22 tons of antimony ore was made to England in August from the Alps mine.

Mr. Oscar V. White, superintendent for the Slocan Star Mines, Ltd., is reported by the "Spokesman-Review" to have said, when in Spokane recently: The drift on our ninth level, 100 ft. above the main adit, has entered a promising body of galena ore much sooner than we expected to reach

the first ore-shoot on this level. On the No. 8 level we have opened two shoots of ore, respectively 125 and 150 ft. in length. The first-mentioned shoot shows an average of 2 ft. 6 in. of clean galena and 4 ft. of concentrating ore. The second shoot varies in width from 5 to 20 ft. The clean ore occurs in alternate bands of lead and zinc, the former predominating. From the zinc ore taken from this drift recently we sorted out by hand a carload that averaged 44 per cent zinc and 45 oz. silver to the ton. Throughout the oreshoots in the lower workings of the mine the silver value runs just about what it did above, namely, an ounce and a quarter silver to the unit of lead. Both of these ore shoots have been raised in to the No. 6 level, the lowest of the old workings. The showing of ore in the second shoot in No. 6 level is especially fine. The main adit (tenth level) will still have to be extended 300 ft. to reach the first ore shoot. Owing to shortage of water, we are working only one shift at present in our concentrating mill, but if rain does not soon come we shall put into operation our auxiliary steam plant and thus remedy this condition. Our rate of production is 150 tons of lead and 250 tons of zinc concentrate monthly. Our zinc concentrate is lower grade than the crude ore when the ore is rich enough to sort by hand; it averages 35 per cent zinc and 20 oz. silver to the ton. We have on hand 2,000 tons which should net us $40,000. We are negotiating with buyers of zinc and expect to soon close a contract. When shipment of zinc shall be resumed, we shall ship monthly about 80 tons of crude zinc ore in addition to the concentrates.

Nelson.—It is stated that arrangements are being made to obtain electric power for operating a compressor at the Eureka copper mine, on Forty-nine creek. The H. B. lead-zinc mine, on Deer creek, a few miles east of Salmo, has been bonded by a Spokane man, whose intention it is to employ 35 to 40 men and to increase the ore output of the mine. Development work is being done on the Aspen group, by P. F. Horton; this property is higher up Deer Creek than the H. B. and Zincton, of which latter Mr. Horton was in charge last year.

Molybdenite.—The following information concerning a group of molybdenite claims in the southern part of Nelson mining division, was recently published in Vancouver: The Molly group, 17 miles from Salmo, owned by Messrs. Bennet, Benson, and Ross, the value in which consists almost altogether in molybdenum, has been bonded by Mr. Morton A. Merrill, of Vancouver, who is putting the property in shape to make shipments of molybdenite from it. Mr. Merrill lately returned to the coast from a visit to the property and stated that preliminary work had been completed. In order to provide for the transportation of the ore, there is required a surface tramway about 1,000 ft. in length down to the millsite; also the construction of a wagon road four miles to connect with the existing road to the Nelson-Spokane railway. Arrangements have been made for these improvements, and the chief question now having the attention of the management is the kind of mill to be put in for concentrating the ore. Mr. G. R. B. Elliott, who is in charge of the work, has been to Denver, Colorado, to see the working of the Wood process, and either a water or oil flotation process will be installed at Lost creek to treat the Molly mine ore. In any case, since the first unit of the plant to be put in will be small, the mill will be only an experimental one, but those interested estimate that they will make a profit even with a small plant. While clearing for the tramway and flume and the preparation of the millsite have been in progress, development of the orebody has been continued, so that there is now enough ore on the dump to supply a small mill for several months. To this information may be added the statement that an account of this property, written by Dr. Chas. W. Drysdale, of the Geological Survey of Canada, who visited the property last autumn, will shortly be printed.

General Notes.

From Hazelton has come news to the effect that by the end of August more than 200 cars of copper ore had been shipped to Anyox from the Rocher Deboule Co's mine, and that after the completion of additional house accommodation for miners more men would be employed and the output of ore be enlarged.

It has been reported that a number of claims on which are showings of copper ore have been located at the head of Snowshoe creek, in Cariboo district. Other mineral claims have been staked for lode-mining in various parts of the district in recent years, but owing to distance from a railway there has not been much development work done on them notwithstanding that indications of the occurrence of ore are promising.

The dead body of a well-known placer miner, named William Stevenson, has been found in his tent near the Similkameen river about a mile above Princeton. As appearances suggested that the deceased had died while asleep, from natural causes, the district coroner did not deem an inquest necessary. Stevenson had not mined long in Similkameen district, but was known in Kaslo and Spokane. Among his effects were found bank deposit receipts showing that he had about $4,000 in several banks.

The Roberts & Schaefer Company, Engineers and Contractors, Chicago, announce the award of the following new Coal Mining Plant contracts:

Messrs. Peale, Peacock & Kerr, of New York, a two-track steel tipple with car haul, using Marcus Patent Picking Table Screen, for Mine No. 9, Winburne, Pa.

Russell Coal Mining Co., Russellville, Pa., equipment for Marcus Patent Picking Table Screen for Mine No. 24.

The National Fuel Company of Denver, Colo., have awarded a contract for a new wood tipple at Shamrock Mine, Colorado.

The Cabin Creek Consolidated Coal Co., of Charleston, W. Va., have awarded a contract for a Marcus Coal Tipple equipment for installation at Kayford, W. Va.

Mr. Geo. L. Carter, President of the Carter Coal Company, Coalwood, W. Va., has authorized the Roberts & Schaefer Company to proceed with the building of a large Marcus Patent Coal Tipple with "Rands" Loading Booms, which was contracted for some months ago, for the new mine recently sunk at Coalwood known as the Olga Mine. This will be one of the largest installations in West Virginia. The Carter Coal Company also gave the Roberts & Schaefer Company a contract last week for a new Marcus wood tipple for Nora Mine at Coalwood, W. Va.

FRENCH'S PROGESS FOR REDUCTION OF ZINC-LEAD ORES.

The "Daily Colonist," published at Victoria, British Columbia, on September 12, printed the following:

The Provincial Government has decided to extend a measure of financial assistance to a mining project which promises to exert an important influence upon the problem of zinc production in British Columbia, and which will, as an immediate development, have the effect of placing in operation at Nelson a demonstration plant.

This announcement is made by Sir Richard McBride, Premier and Minister of Mines, who explained that for some time the Government has had under consideration representations made by the French Complex Ore Reduction Company, Ltd., of Victoria, the chairman of which is Mr. Albert F. Griffiths. The company, which has obtained the patent rights of the French process for the electrolytic deposition of zinc, has made successful experiments with small plants for the past five years, and believes the time has arrived when steps should be taken to demonstrate the commercial possibilities.

Evidence placed before the Government, said Sir Richard, tended to show that the process can be successfully employed on a large scale in the treatment of zinc-bearing ores and after investigation by officers of the Mines Department, it has been decided to assist the company in completing its financial arrangements so that a demonstration plant of some practical usefulness may be established at Nelson. Beside this measure of assistance the Government will lease to the company on favorable terms the old Fairview plant at Nelson, which reverted to the Province some time ago, after it had been abandoned by those who were operating it.

Mr. Griffiths explained last evening that the company was hopeful, as a result of the action of the Government, of being able to make such financial arrangements as would enable it to almost immediately commence putting the Fairview plant at Nelson in order for the demonstration work. It is planned to put in two units, of one-ton capacity each.

Mr. Thomas French, who will superintend the erection of the plant, is at present in the city, and plans to leave for Nelson shortly to survey the Fairview plant. He has no misgivings about the practicability of the project, numerous experiments on a small scale having removed every vestige of doubt on this point. It was Mr. French's father, Mr. Andrew Gordon French, who invented the process for the electrolytic treatment of zinc ores. The latter died only a few weeks ago in Glasgow.

Sir Richard McBride said that the Government was moved to extend a measure of aid to the company at this time in view of the possibility of encouraging the greater production of zinc in British Columbia, a matter of vital concern just now to the Imperial Government, in view of the use of zinc in the manufacture of munitions of war.

GRANBY CONSOLIDATED CO.'S OPERATIONS

The "Spokesman-Review" on September 12, published the following interview with Mr. F. M. Sylvester, general manager for the Granby Consolidated M. S. and P. Co.: "Both plants of the Granby Co. are running at full capacity and together turning out copper at the rate of 3,500,000 lb. a month, or 42,000,000 lb. a year. The smeltery at Grand Forks has eight furnaces in operation, treating 100,000 tons of ore monthly. At the smeltery at Anyox the fourth furnace was blown in about August 15. The quantity of ore treated there averaged 62,500 tons a month for May, June and July; in August about 75,000 tons was smelted. The working force at Anyox, where there is still construction work in progress, numbers between 850 and 900 men.

"About a year ago the Granby Co. added to its holdings the Bonanza mine, near Granby bay, but as we do not at present need its ore we have not yet put it in shape for producing. We also acquired some mines on Prince of Wales island: these were supposed to have been worked out, but we have been taking some ore from them, chiefly from the Mamie, worked at one time by Sam Silverman. We have developed the Midas mine at Valdez, Alaska, to the shipping stage, but owing to a scarcity of vessels we have not yet been able to ship ore thence to Anyox, and we may yet have to buy our own steamer for this purpose.

"To the best of our ability we are encouraging mine-owners in Northern British Columbia and Alaska to ship their ore to Anyox, but as yet we have not received much custom ore. The only shipper on a comparatively considerable scale has been the Rocher Deboule mine, near Hazelton, B. C., from which during the last two months we have received about 6,000 tons of copper ore."

A ONE-MAN POWER DRILL.

A new type of powerful coal drill has been recently developed and placed on the market by the Jeffrey Mfg. Co., of Columbus, Ohio, builders of coal mine and tipple equipment.

The motor and drill mechanism proper are mounted on trunnions in a carriage, which may be raised or lowered in a vertical channel-iron frame by means of a 3-8 in. steel rope. One end of this rope is fastened to the top yoke of the frame and the other end to a drum on the carriage. This drum is rotated by a handle to wind up the rope and to raise the carriage. A ratchet and pawl are provided on the drum to prevent the carriage from dropping when the handle is released.

When it is desired to move the drill from one place to another, the carriage carrying the motor and mechanism is lowered to the bottom of the frame and the drill rolled along on the wheels provided on the bottom cross-yoke, in a manner similar to an ordinary hand freight truck.

The motor of this drill is rated at 3 h.p. The total weight of the drill is approximately 300 lb. It is made sufficiently rugged and powerful to drill through any material against which the auger will stand up.

With the means employed on this drill for raising and lowering and with the wheels provided for moving it from place to place, only one man is required to move, set up, adjust and operate the machine.

Full particulars regarding this drill can be obtained by writing to the Jeffrey Manufacturing Company, Power Building, Montreal.

TECK-HUGHES.

Teck-Hughes Mines were formally handed over to the Buffalo Mines crowd at the annual meeting of the former company held in Toronto, Sept. 17th. Mr. C. L. Denison of Buffalo was elected President and General Manager of the new company, R. W. Pomeroy of Buffalo Vice-president, H. D. Crooks of Toronto Secretary, and H. Clark of Cobalt Treasurer. The directors are A. W. Johnston and J. F. Thompson, both of New York.

By the agreement of purchase two-thirds of the issued stock of Teck-Hughes was sold to the new interests at slightly below the present market value, which is $7\frac{3}{4}$. The four by-laws brought before the company were put through. A bond issue will be made amounting to $150,000 for working capital, which is to be taken up by those now in control.

Some time after Teck-Hughes was organized, London interests got an option on the property, and after expending $37,500 on development work refused to take up the option. Nipissing next got an option, and after spending $40,000 backed out because they could not agree as to the purchase price. Ore was blocked out by them, however, valued at $350,000. Actual work is now under way, and a plant is being erected of one hundred tons capacity. The shaft on the mine is already down 265 ft., and 3,000 ft. of drifting has been done. The Teck-Hughes property lies four miles from Swastika.

FUEL SUPPLY OF THE PRAIRIES.

One of the most important problems in Canada at the present time is the provision of an adequate supply of cheap fuel for the population of our Prairie Provinces. Very large areas of these provinces are underlain by beds of subbituminous coal and lignite, which are estimated to contain 100,000,000,000 tons of these fuels. As yet, however, practically all the fuel used in that portion of the plains east of Brandon is imported from the United States, while that used in the country west of Brandon is brought chiefly from the coalfields of the Rocky mountains. This entails a long and expensive haul, which results in a high-priced fuel, and any temporary interruption of the supply gives rise to a coal famine.

The reason why the mineral fuels of the plains have not been utilized is that they are expensive to mine, owing to the absence of supplies of mine timber on the treeless prairies; they are also of a lower grade than the coal from the Rocky mountains, containing a large percentage of moisture. They thus have a lower heating value than the fuels from the mountains, and furthermore when they are exposed to the atmosphere after being mined, they dry out to a certain extent, and in so doing crumble to pieces or even fall to powder, so that they cannot be readily handled and will not bear transportation. Such being the case, if these fuels are to be made available for household use, they must be briquetted, or if they are to be used for manufacturing purposes, they must be either briquetted or used in gas producers.

A series of trials of Canadian fuels, recently carried out by Dr. J. B. Porter and Prof. Durley of McGill University for the Mines Branch of the Department of Mines at Ottawa, show that these fuels of the plains are excellently adapted for use in the gas producer and are thus well suited for the production of power. The question as to whether they can be briquetted, when necessary, at a sufficiently low cost to make the enterprise commercially profitable, has not yet been established. Fuels of this general type are briquetted in Germany, on an enormous scale, and the United States Bureau of Mines is now investigating the possibility of briquetting the lignites of North Dakota. Any lignite can, of course, be briquetted if a suitable binding material is employed. This however, entails additional expense, but many of the German lignites and some of those occurring in North Dakota can be briquetted without the addition of any binding material. It is thus very important that an investigation should at once be made into the question as to whether there are not, among the great deposits of fuel underlying the Canadian plains and outcropping on their surface, some at least which can be worked for the production of a cheap briquetted fuel which will stand transportation, and thus supply a need ever more insistent as the population of the Prairie Provinces increases.—Dr. Frank D. Adams, at 1915 Annual Meeting of Commission of Conservation.

AMERICAN MINES AND WORKS DIVIDENDS.

With an even 100 companies participating, there were dividends amounting to $44,708,963 paid to stockholders of American mines and works during the first 8 months of 1915, according to reports made to Mining and Engineering World. While this record is considerably below that paid during the same period in 1914, there is every indication that the remaining 4 months will witness record-breaking dividend disbursements, which will bring the total for the year to as large a figure as that for 1914.

What with heavy demands for the various metals at much higher prices than a year ago, and with a promise of a continued demand for some time to come, matters pertaining to the mining industry in general are particularly promising.

The 100 companies participating in the above disbursements have an excellent record in that they have paid dividends since incorporation of $917,540,919, on an issued capitalization of $702,510,525.

Of the above, 28 are copper properties, all but one operated in the United States, and they participated in the present year's disbursements to the extent of $18,508,417. Since incorporation these companies have paid dividends totaling $146,450,651. Issued capital totals $243,818,550.

Fifty-one of the above companies operate gold-silver-lead-zinc properties and their disbursements for the 8 months total $13,785,857, and since incorporation $213,390,336. Eighteen are Canadian properties, with disbursements to their credit during the 8 months' period of $3,618,196, and since incorporation $30,895,710. Two [illegible] companies report as having paid dividends in 1915, they having paid but $652,821.

Six metallurgical companies have had a prosperous year, for they have divided among shareholders so far this year $8,249,672. Since incorporation their combined disbursements total $173,859,281.

Six securities-holding corporations have distributed dividends so far this year amounting to $9,571,[illegible]15, and since incorporation $186,543,767.

MARKETS

STOCK QUOTATIONS.

(Courtesy of J. P. Bickell & Co., Standard Bank Building, Toronto.)

Sept. 23, 1915.

New York Curb.

	Bid.	Asked.
American Marconi	37.00	37.50
Alaska Gold	32.25	32.50
British Copper	.50	1.00
Braden Copper	8.75	8.87½
California Oil	308.00	310.00
Chino Copper	45.00	45.25
Giroux Copper	.50	1.50
Goldfield Cons.	1.25	1.31¼
Green Cananea	40.00	42.00
Granby	85.25	85.50
Inspiration Copper	35.00	36.00
International Nickel	216.00	217.00
Miami Copper	27.50	27.75
Nevada Copper	14.25	14.50
Ohio Oil	147.00	149.00
Ray Cons. Copper	21.87½	22.00
Standard Oil of N. Y.	198.00	200.00
Standard Oil of N. J.	473.00	476.00
Standard Oil (old)	1375.00	....
Standard Oil (subs.)	975.00	....
Tonopah Mining	5.25	5.37½
Tonopah Belmont	3.87½	4.12½
Tonopah Merger	35.00	37.00
Yukon Gold	2.25	2.62½

Porcupine Stocks.

	Bid.	Asked.
Apex	.03	.03½
Dome Extension	.28¾	.29¼
Dome Lake	.22	.23½
Dome Mines	22.00	23.25
Foley O'Brien	.28	.35
Hollinger	25.35	25.70
Jupiter	.11¾	.12
McIntyre	.48	.48¼
Moneta	.07	.07¼
Pearl Lake	....	.00½
Porcupine Gold	....	.00⅝
Porcupine Imperial	.06⅝	.06⅞
Porcupine Crown	.71	.73
Preston East Dome	.05⅛	.05¼
Porcupine Vipond	.67½	.68
Porcupine Tisdale	.01½	.02
West Dome	.08¼	.08½

Cobalt Stocks.

	Bid.	Asked.
Bailey	.05	.05⅛
Beaver	.31	.32
Buffalo	.45	.65
Chambers Ferland	.14	.16½
Coniagas	4.00	....
Crown Reserve	.37	.38
Foster	.03	.04½
Gifford	.01½	.01⅞
Gold Reef	.03⅞	.04¼
Gould	.00½	.01
Great Northern	.02¼	.03
Hargraves	.01⅛	.01¼
Hudson Bay	20.00	25.00
Kerr Lake	3.85	4.00
La Rose	.48	.54
McKinley	.23	.25
Nipissing	7.25	7.35
Peterson Lake	.22	.22¼
Right of Way	.05⅜	.05⅝
Silver Leaf	.01½	.02
Teck Hughes	.08½	.08¾
Temiskaming	.37	.37¼
Trethewey	.12½	....
Wettlaufer	.08	.10½
Seneca Superior	....	.75

TORONTO MARKETS.

Sept. 25, 1915—(Quotations from Canada Metal Co., Toronto)
- Spelter, 18 cents per lb.
- Lead, 6¼ cents per lb.
- Tin, 37 cents per lb.
- Antimony, 40 cents per lb.
- Copper Casting, 19 cents per lb.
- Electrolytic, 19 cents per lb.
- Ingot brass, yellow, 13c.; red, 15 cents per lb.

Sept. 25, 1915—(Quotations from Elias Rogers Co., Toronto)
- Coal, anthracite, $7.75 per ton
- Coal, bituminous, $5.25 per ton.

NEW YORK MARKETS.

Sept. 23, 1915—Connellsville coke (f.o.b.) ovens—
- Furnace coke, prompt, $1.65 to $1.75 per ton.
- Foundry coke, prompt, $2.30 to $2.60 per ton.

Sept. 23, 1915—Tin, Straits—
- Copper, Prime Lake, 17.62½ to 17.87½ cents.
- Electrolytic copper, 17.75 to 18.00 cents.
- Copper wire, 19.25 to 19.50 cents.
- Lead, 4.50 cents.
- Spelter, 14.00 to 14.25 cents.
- Sheet zinc (f.o.b. smelter), 16.00 cents.
- Aluminum, 98 to 99 p.c., nominal, 48.00 cents.
- Platinum, soft, $50.00 to $54.00 per ounce.
- Platinum, hard, $54.00 to $58.00 per ounce.
- Quicksilver, $89.00 per 75 lb. flask.

SILVER PRICES.

September—	New York.	London.
10	48⅞	23⅝
11	48¾	23½
13	48⅝	23½
14	48¼	23½
15	48½	23½
16	48⅝	23½
17	48¾	23⅝
18	48⅝	23½
20	48¾	23½
21	49⅛	23¾
22	49¼	23¾
23	49⅛	23⅝

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The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

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Map 39A. Geological Map of Nova Scotia.

QUEBEC
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Boving & Co. of Canada, Ltd.

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Locomotives—Steam—
Mussens, Ltd.

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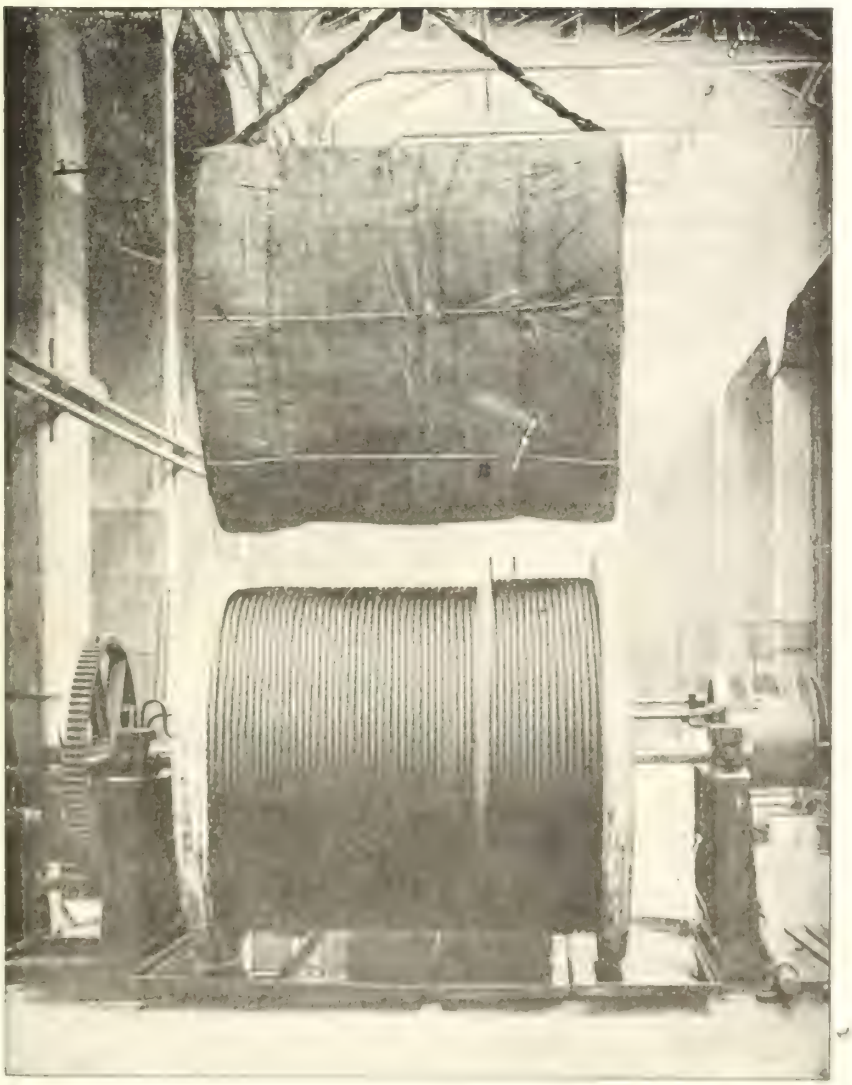

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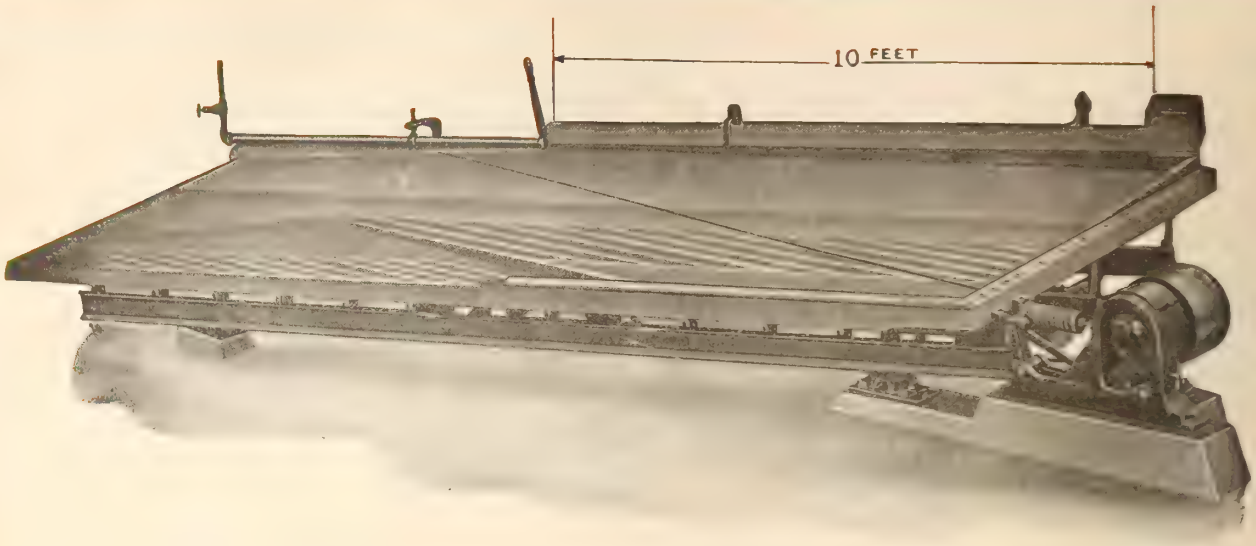

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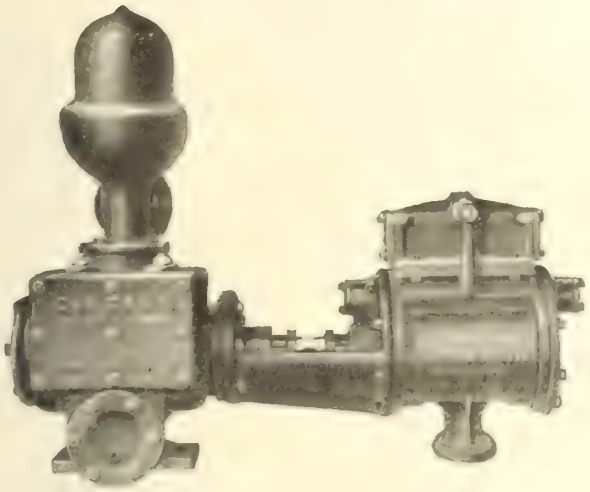

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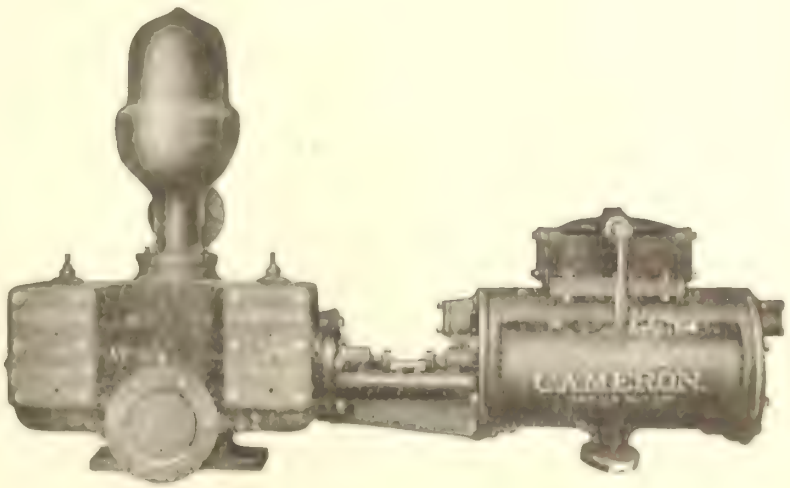

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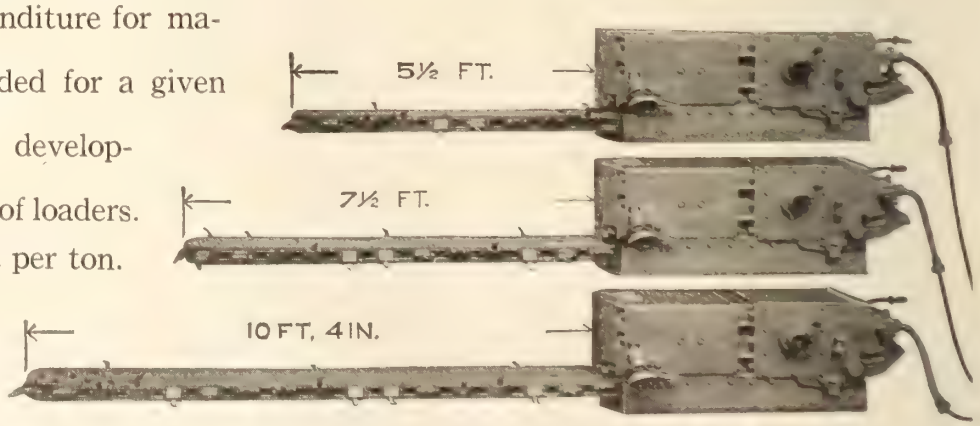

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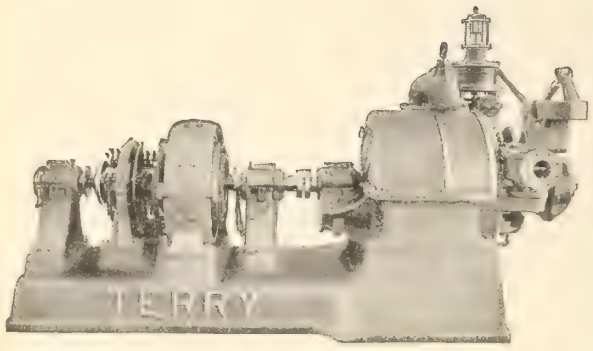

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Application for a lease must be made by the applicant in person to the Agent or Sub-Agent of the district in which the rights applied for are situated.

In surveyed territory the land must be described by sections, or legal sub-divisions of sections, and in unsurveyed territory the tract applied for shall be staked out by the applicant himself.

Each application must be accompanied by a fee of $5 which will be refunded if the rights applied for are not available, but not otherwise. A royalty shall be paid on the merchantable output of the mine at the rate of five cents per ton.

The person operating the mine shall furnish the Agent with sworn returns accounting for the full quantity of merchantable coal mined and pay the royalty thereon. If the coal mining rights are not being operated, such returns should be furnished at least once a year.

The lease will include the coal mining rights only, but the lessee may be permitted to purchase whatever available surface rights may be considered necessary for the working of the mine at the rate of $10.00 an acre.

For full information application should be made to the Secretary of the Department of the Interior, Ottawa, or to any Agent or Sub-Agent of Dominion Lands.

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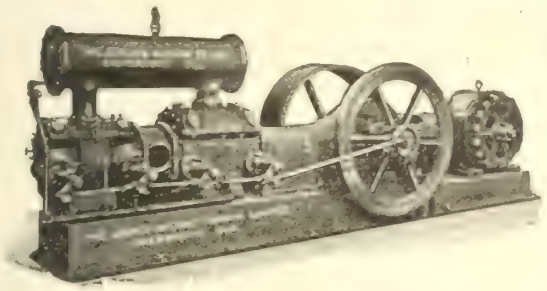

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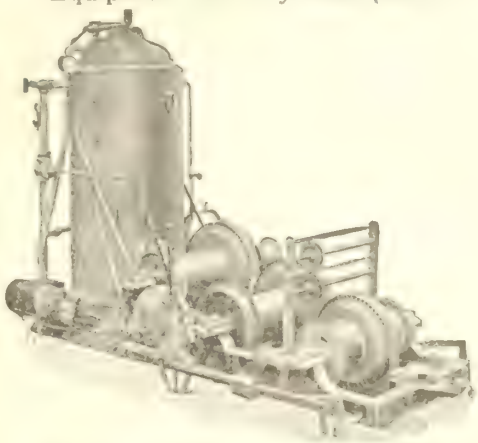

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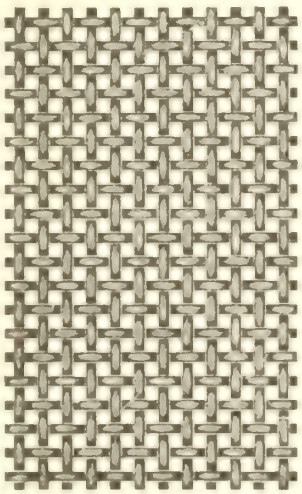

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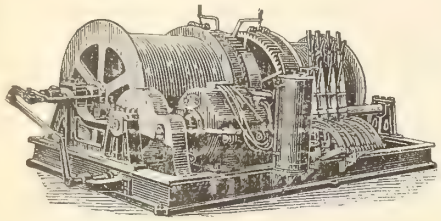

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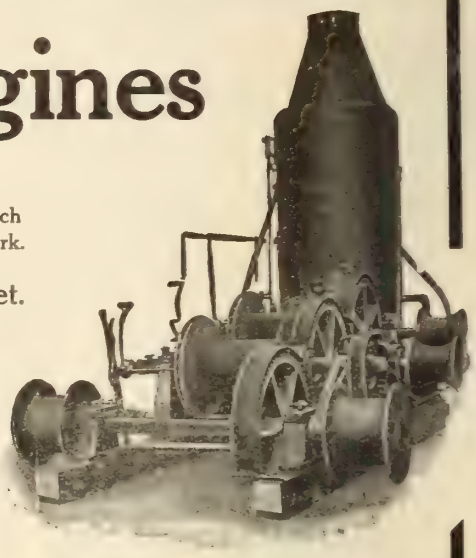

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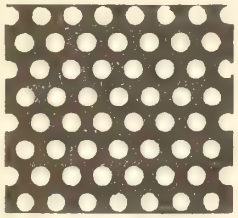

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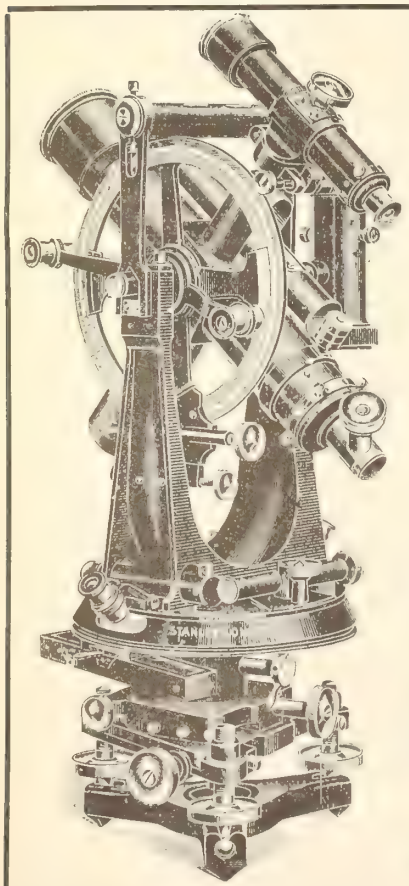

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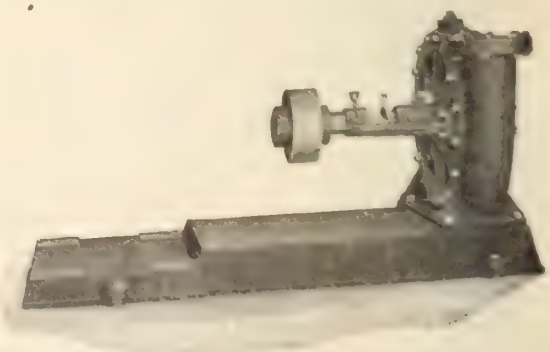

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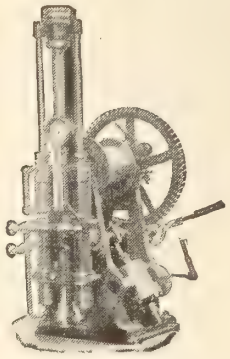

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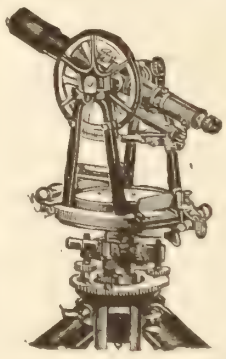

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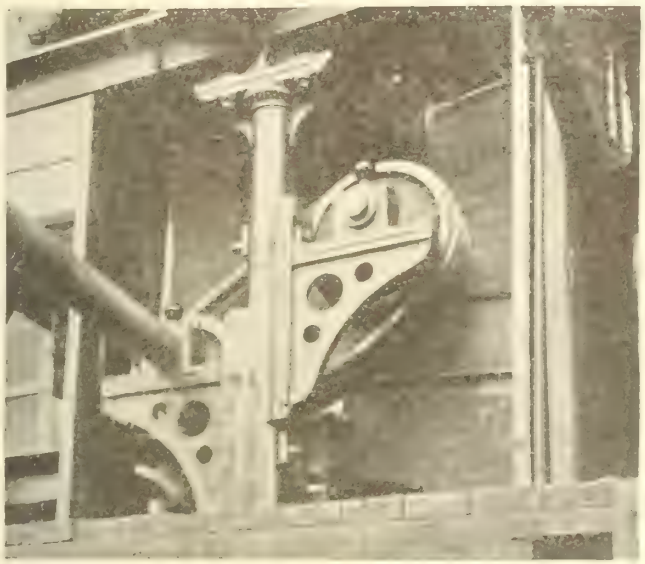

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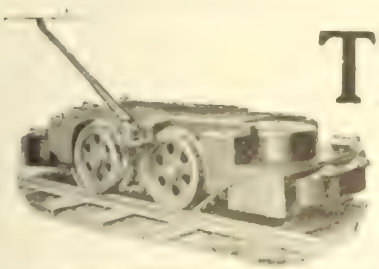

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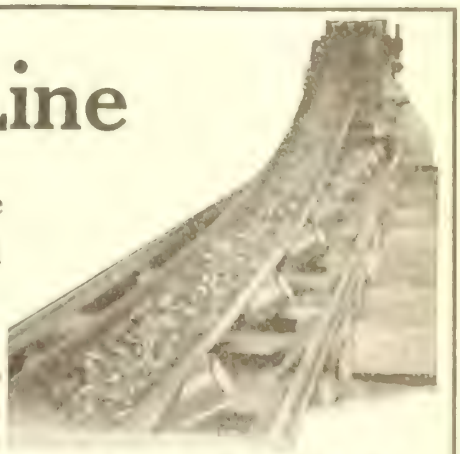

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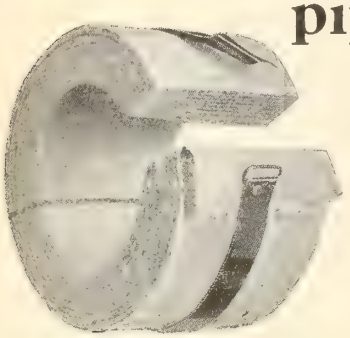

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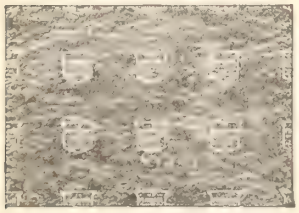

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TORONTO MONTREAL WINNIPEG VANCOUVER

THE CANADIAN MINING JOURNAL

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RESEARCH AND INDUSTRY

Since the war began there has been a great change in many industries and importers and manufacturers have been brought face to face with many new problems. New sources for raw materials have been sought in all parts of the world and methods of utilizing different raw materials have been devised. The removal of Germany and her allies from world trade has given unexpected opportunities as well as affording some initial embarrassment for certain manufacturers. The enormous demand for war supplies has created a better market for many materials and some products almost unsaleable before the war are greatly in demand. In several lines there is an opportunity now of establishing industries which, if economically managed, should be able to get a firm footing and be in position to withstand foreign competition later.

Those who establish new industries or improve old ones always have to meet many difficulties. Many of these have been removed by scientific research. It often happens that a series of experiments will disclose a simpler and cheaper method of performing some detail of a process. Everyone knows this; but it is not every manager that troubles to have the necessary research done, though few are so short-sighted as not to encourage members of their staff who carry on experiments to improve methods.

Many of the necessary investigations are satisfactorily carried on in the mine or at the mill, smelter or refinery. Many problems are, however, not tackled because of lack of proper facilities.

In this issue Mr. F. M. Turner, Acting Secretary of the Bureau of Scientific Research and School of Specific Industries, Royal Canadian Institute, Toronto, outlines what is hoped to be accomplished in Canada by the recently organized Bureau. The work accomplished by the Mellon Institute is becoming very favorably known and the establishment of a similar Bureau in Canada is much to be desired.

The "Mineral Industry" for 1914 has been issued and compares well with former volumes. Of especial interest are the notes showing the effect of the war on the various phases of the industry. In most cases the story is of depression during the first few months and then gradual or even very sudden improvement. The account of progress in 1915 will be a much more absorbing one.

The market for silver has been firmer lately and predictions of good prices may yet be realized. So far, however, the advance from the lowest price of the year has not been very large.

A SCHOOL FOR MINERS

A few years ago there was established in the Marquette iron mining district of Michigan a school to increase the efficiency of the employees of the Cleveland-Cliffs Iron Co. This new departure was watched with considerable interest and there was no little difference of opinion as to how the miners would receive it. Very satisfactory results have, however, been obtained and in a paper presented at the September meeting of the Lake Superior Mining Institute, and reprinted in this issue of the Journal, Mr. C. S. Stevenson says: "On June 1st, 1915, the work of the first class, comprising 33 men, was completed, and it can be stated definitely that for the greater period of their course the men manifested a higher degree of open-mindedness and enthusiasm than is usual in high schools and universities."

The results obtained are very complimentary to those who originated the idea and developed the courses of study. One feature which doubtless appealed to most of the men was the decision of the company to choose its shift bosses from the ranks of the school. Another feature which proved successful was the fixing of attention on one subject and continuing the instruction of that subject alone instead of teaching several subjects at one time. An interesting diversion from the routine of school instruction was provided by informal discussions on topics intimately connected with the miners' work.

The school, it should be pointed out, is not, and was not intended to be, a primary school for miners who do not understand English. It is a school for the more ambitious among the English-speaking miners.

Apparently Mr. W. R. Ingalls has not much confidence in hydrometallurgical methods for the treatment of zinc ores. In a very interesting paper presented before the International Engineering Congress in San Francisco, and published in the October 2nd issue of "Mining Press," Mr. Ingalls traces the important steps in the improvement in methods of treating zinc ores. The introduction of Wilfley tables for concentrated mixed ores, Wetherill's system of magnetic separation, Blake's system of electrostatic separation, and the flotation process as used at Broken Hill, mark some of the greatest advances. Hydrometallurgical methods, while considered commercial possibilities are said to have failed to come into extensive use simply because most ores can be treated more profitably in other ways. Mr. Ingalls remarks, however, that while "the precipitation of zinc from solutions by electrolysis used to be troublesome and unsatisfactory, that seems to have been mastered."

It seems likely that control of the Jupiter mine at Porcupine will soon be taken over by the McIntyre Mining Company. The Jupiter is a promising mine, but has not yet had a chance to become a regular producer. Its addition to the list of operating properties will be another important step in the development of the Porcupine gold district.

The Department of Mines has issued a report by Albert O. Hayes on the Wabana Iron Ore of Newfoundland. The paper is a presentation of a detailed study of the petrology and chemistry of the iron ore. As the Wabana deposits are the source of the iron ore produced by the Dominion Iron and Steel Co. and the Nova Scotia Steel and Coal Co., they are of almost as much interest to Canadians as to Newfoundlanders. Mr. Hayes' work is illustrated by photos showing the oolitic character of the ore.

British subjects in the Clifton-Morenci copper mining district have appealed to the British consul for protection, and the consul has asked Governor Hunt, of Arizona, to provide it. Federal and State authorities have so far failed to send troops for the protection of lives and property in the strike district, and the British subjects are apparently unwilling to submit to Moyer rule. We don't wonder at it.

The iron industry of the United States is now experiencing one of the best periods in its history. A year ago there was considerable pessimism as to the outlook and in December, 1914, pig iron production fell to 1,495,346 tons. Every month of 1915 has registered an increase in production and September broke all records with a production of 2,834,342 tons. The improvement is a wonderful one.

UNIVERSITY OF BRITISH COLUMBIA.

The new University of British Columbia commenced its educational work in Vancouver, B. C., on October 1st. Two new temporary buildings have been completed for the departments of Geology and Mineralogy, and alterations have been made in the building formerly used by McGill College for the use of the Science department devoted to Physics and Chemistry. The library, administration offices and lecture rooms will be in another new building. These arrangements are temporary, pending the erection of the university buildings according to plans fully considered and adopted, but deferred during the war on account of financial considerations. The library contains 30,000 volumes.

The officers of the University are: President, Dr. F. F Wesbrook; registrar, Mr. C. E. Robinson; assistant librarian, Mr. John Riddington. Two colleges and eleven departments have been organized and the staff for them appointed. Mr. Reginald W. Brock is Dean of the College of Applied Science. In the Department of Geology and Mineralogy, Mr. Brock is professor and Dr. D. D. Cairnes assistant professor. In the Department of Mining and Metallurgy, Mr. J. Monerieff Turnbull is professor. In the Department of Chemistry, Dr. Douglas McIntosh is professor of chemistry and head of the department, and Dr E. H Archibald is assistant professor. In the Department of Civil Engineering, Mr. H. K. Dutcher is assistant professor. In the Department of Mechanical Engineering, Mr. I. Killam is assistant professor, and Mr. F. C. G. Wood lecturer.

CORRESPONDENCE

PERSISTENCE OF ORE IN DEPTH

To the Editor of the Canadian Mining Journal:

Sir,—In your issue of Sept. 15th, there is an editorial criticizing adversely my comments on Mr. Rickard's paper, "Persistence of Ore in Depth," given before the Institution of Mining and Metallurgy. As I consider that this editorial is not even an honest presentation of the arguments employed, I would be obliged if you would give me space to reply.

The original paper of Mr. Rickard and the discussion thereon is only available to members of the Institution, of whom there are only about 90 resident in Canada, consequently most of the readers of your article will not have had the opportunity of judging for themselves whether the presentation given in your journal is reasonable or not. Anyone who has read the discussion must be aware that a number of those who argued against Mr. Rickard's conclusions employed theories of ore genesis in doing so. For instance, on p. 39 of Bull. 129, one member says: "It seems to me that the genesis of the ore, character of the enclosing rocks. . . . . are the factors that really count when we come to consider the probable depth to which profitable ore will descend." The genesis of the ore is, of course, our conception or theory of the genesis. Again on p. 28 and for several pages following of Bull. 125 of the Institution, theory is used at length to combat Mr. Rickard's conclusions. The answer then to the indignant exclamation in your editorial, "But who under heaven would think of using any other basis?" is that those preceding the writer in this discussion had used another basis, and therefore, I think, justified the expression employed by me which the editorial refers to and even partially quotes, viz.: "Mr. Rickard's paper appears to be a most important and valuable contribution in this direction, and, I think, more likely to lead to a useful result than the voluminous discussions of the way ore has been formed and the deductions therefrom which are so dear to geologists."

The writer of the editorial professes to be unable to see the application of the illustration given of the failure of the universally accepted theory of the uniform drop in temperature with decrease in air pressure above the surface of the earth. I may say that others with whom I have discussed the matter think it pertinent, and consider that as the theory which dealt with conditions above the crust of the earth and which seemed to be beyond dispute, is found to fail entirely, we should hesitate about presenting with the confidence exhibited in the discussion under question, theories of something taking place below the surface of the earth, which is admittedly much more complex.

Yours, etc.,

Toronto, Sept. 30, 1915. G. R. MICKLE.

LAKE SUPERIOR CORPORATION.

At annual meeting of the stockholders of Lake Superior Corporation in Camden, Harvey T. Underhill and A. H. Chitty were elected directors to succeed respectively Chas. B. Gordon and J. Frater Taylor. The remaining present directors were re-elected. Following the meeting the board organized by electing W. E. Stavert president, to succeed Thomas Gibson, who continues as general counsel. The board [illegible] W. [illegible] and H. Cappell vice-presidents, and James Hannan [illegible] president to succeed J. F. Taylor.

ARIZONA STRIKE.

Phoenix.—The great copper camp, comprising Clifton-Morenci-Metcalf district, will remain shut down. This is the result of the Western Federation of Miners entering the district and calling a strike September 11th which closed all departments. The mine managers of Arizona Copper Co., Detroit Copper Co., and Shannon Copper Co. have delivered to committees of employees their reply to employees' demands which was as follows:

"These companies have seen their properties closed down and their operations tied up completely by a strike called by Western Federation of Miners, and this without any presentation of grievances. Our former employees have been persuaded by agitators of the Western Federation of Miners coming from outside this district that past pleasant relations and present rate of wages should be radically changed. The companies are convinced that a large number of their old employees desire to go to work under the conditions formerly existing in this district, but they realize that any attempt to recommence under such conditions will be to invite violence and intimidation. Therefore the mines and plants will remain idle indefinitely. When it shall appear that conditions in this section warrant it and the companies are satisfied that general sentiment of the community and their former employees is unanimously in favor of a resumption of operations on basis of wages and conditions which have prevailed heretofore in this district, the companies reserve to themselves the right to decide as to whether or not they will again start up their plants.

"Our attitude in this matter is based solely on the dominant influence of the Western Federation of Miners in this district at the present time, and when this influence is dissipated we may take a different view of the situation."

At 11 o'clock Sunday, September 26th, a joint committee of employees and company managers went into session at Clifton. Unofficially, it is announced that committee of employees demanded minimum wage of $3.50 per day for underground men and $4.25 per day for mechanics. These figures are based on a 13-cent copper market, with a sliding scale upwards with advance in copper prices. At 4 o'clock no agreement had been reached; meeting was adjourned with a complete deadlock existing. Officers of Detroit Copper Mining Co. and Shannon Copper Co. stated that to meet demands made upon them would make it impossible to operate their properties profitably with copper at 13 cents.

NICKEL COMMISSION VISITING PROPERTIES.

The Ontario Nickel Commission has returned to Toronto after visiting the Sudbury, Cobalt and Porcupine mining districts. The chairman, Mr. Holloway, was especially interested in the splendid smelting plants at Copper Cliff and Coniston, and was agreeably surprised with the excellence of the electrical power available at all three mining camps. The visit to Sudbury was merely a preliminary visit. Another will soon be made and more time spent on the properties and in gathering information and opinions from all sources in the district.

The Independent published at Kaslo, B.C., says that on September 22nd, the Kootenay Belle Mines, Ltd., declared its first dividend in twelve years, the distribution amounting to two cents a share on the outstanding stock. The total payment on this account will be $35,000, of which one-half is payable on October 15th and the other half on December 15th next.

PREPAREDNESS

(As the Overseas News Agency might put it.)

All things had we prepared and planned
With scientific thoroughness,—
Supplies and schemes on every hand,
And nothing left to chance or guess:

Goosestep, and all it signifies
Of drill and tactics cut and dried;
Strategic rails,—as shuttle flies,
Our corps could shift from side to side.

The "42," and those gray-green
New uniforms that mock the grass;
The zeppelin, the submarine,
And, neither last nor least, the gas;

Our settled route 'cross Belgian soil;
Our eye on France's colonies;
That Britain's for revolt would spoil,—
We'd reckoned all such things as these.

And all of these have slow come out
(Except the few that came out wrong);
Now comes another phase about,—
A new one, that we'd figured long.

We've driven west, we've driven east,
Now south we try a new frontier;
Another proof, friend, there thou seest
Of our preparedness made clear.

Not only did we fezzes don,
But in between we sowed and tilled;
Not only promises tried on,
But certain consort chairs we filled.

A princess here, a princess there,
(Of whom a plenty we've to send),
A little Balkan throne to share,—
And Mars of Hymen makes a friend!

Let chambers, mobs or premiers vote
Howe'er they will, we've got 'em snared;
In king behind the petticoat
Their match they find—that we prepared!

—Boston News Bureau Poet (B. F. Griffin).

ZINC METALLURGY.

Developments in the metallurgy of zinc have been for many years conspicuous by their absence. A few years ago great expectations were aroused by the promises of those working with electric furnaces, but so far we have only the promises, which now arouse little enthusiasm.

Canada has an abundance of zinc ores; but produces no zinc. The United States has been producing approximately one-third of the world's zinc and consuming in her manufactures practically all her product. She has suddenly been called upon to supply the enormous demand of the Allies for zinc, for brass making purposes. Every zinc smelter in America is running at the highest possible rate, but still the price of spelter is from three to four times normal.

Localities for zinc smelters are located where there is good fire clay for retorts and condensers and where fuel is cheap. Natural gas or producer gas made from cheap coal are very desirable.

The activity in zinc is stimulating research. Ores that are valueless to the zinc smelter are being investigated to find out if it is not possible to realize on their zinc content at the present time. Such ores are sulphides of zinc, mixed with either sulphides of lead, copper or iron, or possibly all three. Such ores exist in Western Canada, but no matter how high the zinc content, if they cannot be freed from iron, copper and lead they are valueless for retorting.

Roasting-leaching Process.—Very promising results are being obtained in several different places with a sulphatizing roast followed by leaching with sulphuric acid and electrolytic precipitation of the zinc. This follows very closely the recent work in the hydrometallurgy of copper. The ore may be given a preliminary treatment by some form of concentration, in order to get the zinc content in smaller bulk. This may be done on tables or jigs, or a flotation concentrate may be produced.

The concentrate, or the original ore, is roasted at a temperature of 700° to 750°C. for from five to six hours, and then leached with a solution containing 12 to 15 per cent. sulphuric acid. The acid is neutralized with excess of roasted ore. The solution is oxidized, and iron is precipitated, by zinc oxide. Copper if present is thrown down with metallic zinc (zinc dust). The solution is then made quite acid and sent to the precipitation tanks, where it is electrolyzed, using a hard lead anode, and in some plants, a current density of 100 amperes per square foot of cathode. The cathode zinc, firm and very pure, is then melted into bars.

The ore residue after extraction of the zinc may be smelted for its lead and silver, and is more valuable to the smelter with the zinc removed.

GRANBY CONSOLIDATED.

It cost Granby Consolidated an average of 10.66 cents a pound to produce its copper during the fiscal period ended June 30th. The Phoenix mines were unable to turn out copper for less than 11.59 cents, but this was due in great part to the shut-down of last year brought about by the curtailment in production. At the new property in Hidden Creek an average cost of 10 cents was attained, but production there did not start until early in 1915.

The recovery from the Hidden Creek ores was 34.58 lb. of copper, while that from the old mine at Phoenix was down to 16.12 lb. The average for the combined operation was 23.99 lb.

At the end of the fiscal year the Hidden Creek property had estimated ore reserves of 18,000,000 tons, of which 9,205,837 tons were 2.2 per cent. copper and 8,628,000 of 0.63 per cent. material. Reserves at Grand Forks were 4,232,305 tons; the year's extraction was 611,000 tons and there was added to tonnage 152,873 tons through development.

The Bonanza mine has about 900,000 tons of developed ore, of which 414,775 tons averages 2.6 per cent. copper and 489,580 tons averages 0.7 per cent. copper. On Prince of Wales Island the company owns properties with reserves of 130,000 tons of about 1½ per cent. copper ore. The Quartz claims were bought to afford a supply of clean quartz. The Midas mine in Alaska will be ready to ship as soon as arrangements for power to operate the compressor have been completed.—Boston News Bureau.

THE VALUE OF RESEARCH TO INDUSTRY

By Francis Mills Turner.*

Under the stimulus of the present war a change which has long been impending is taking place very fast. This change is the shifting of the world's industrial centre from Europe to America. After years of constant and largely unrewarded effort on the part of a few pioneers, the manufacturers of the United States have during the last decade begun to learn the lesson taught the world by Germany, the lesson of the usefulness of the scientist in industry.

The rapid rise of the American republic to the position she now holds in the world of commerce reflects less credit on her population than has generally been assumed. That rise has largely been engineered by wasteful and unwise exploitation of natural resources so enormous and varied that even when developed in the most blundering and unscientific manner they could not but help to reward those who interested themselves in their development with a large financial return. Along with this the American business man showed an ability for organization and a genius for thinking in large amounts quite unique in the history of the world, and much of the commercial success of the United States is due to the formation of enormous corporations and syndicates, thereby reducing the cost of operation and controlling prices. But this American business mind, so alert to the possibilities of business organization, has been peculiarly blind to the benefits of scientific methods of manufacture, to the conservation of natural resources, to the improvement of products and to the cheapening of wasteful methods of manufacture and the redemption of valuable by-products.

This neglect of the proffered aid of science to industry may largely be attributed to two or three causes. The blame is not all incumbent on the man of business. The scientist, we all admit, has been too prone to clothe himself in a mantle of academic dignity and shun industry and trade as ignoble pursuits of minds of an inherently baser type. Fortunately such scientists are rarer in America than in Europe, but there have been enough of them to discourage many manufacturers from seeking the aid of scientific talent in solving their problems. Secondly, the men in control of industries in America have not, except in the New England States, been largely recruited from university graduates. This has been partly due to an overcoming contempt for the "bookworm" on the part of the "self-made man" and partly to the fact that the colleges failed to train minds suitable for the control of great and growing industrial concerns. As a result of this absence of university graduates in the ranks of the captains of industry, there was a distrust of anything a university man might have to say regarding the conduct of an industry. It was felt that his advice was impractical and unsuited to actual working conditions. Thirdly, the resources of the land were so great that to many it appeared that they were inexhaustible, and the cynical scientific struggling after the utmost efficiency which characterized the industries of Germany, Belgium, and France was felt to be out of place in America, and unwisely considered as a kind of commercial penury that ill befitted the heirs of the immense resources of mine and forest wealth Providence had seen fit to dower the American continent with.

All this had sooner or later come to an end. During the last ten years the great leaders of the industrial world of America have seen that they can no longer play the part of "Coal-Oil Johnny." They have realized that just as the natural resources of Europe have dwindled, so will the natural resources of America, only at a much faster rate, for more iron ore and coal and other natural products are consumed to-day in a single year than were consumed in a decade at the beginning of the last century.

There seem to be some persons in Canada who imagine that their country is in some way different from Europe or the United States, that because the resources of the Dominion are immense, they are inexhaustible. Nothing could be more foolish, and in view of the fact that Canada has all the experience of her great neighbor to profit by, she would be doubly foolish if this opinion found any foothold in her industrial system.

For the three reasons mentioned above, the scientist that the German industrialist made so useful in his scheme of things was not summoned to the aid of industry in America. Industry, for the reason shown above, got along very well without him—for a time, and the scientist retired to his peaceful laboratory and solved interesting and abstruse problems and thought he got on very well without industry or its material rewards.

In all these [illegible] Canada has carefully copied the United States. She is to-day allowing giant corporations to wax fat and establish themselves, in spite of the fact that our papers are full of the accounts of the tremendous (and largely unsuccessful) efforts both Federal and State governments in the older nations south of us are making to control these corporations and make them serve the people and the State rather than subjugate the people and position the State to their own purposes. But Canada has been equally as alert in copying the sins of omission of the American industrial system as its sins of commission, and the industrial scientist finds little more welcome and reward in Canada to-day than he does in the United States. In fact, one might say less, for [illegible] American manufacturer has been slowly waking up during the last few decades, his Canadian confrere is still sound asleep. We speak in general terms. There are notable exceptions both in Canada and the United States, all honor to them.

However what must be forgiven in the case of the United States cannot possibly be forgiven in Canada, for the older nation had not one to go to school to, either as a shining example or a horrible warning, in both of which capacities the present conditions of science and industry in the United States can serve Canada.

Canada is a new nation. Many of its resources are unmarked. It has the opportunity of leading the world in many lines of scientific industry and the next few years are to be the critical ones. Many electrical and metallurgical industries [illegible] and many [illegible] the present [illegible] possible now the presence of the [illegible] of the German personality and [illegible] the [illegible] great chemical corporations are [illegible] us in America for the first time. Will they remain

*Acting Director Bureau of [illegible] and Forestry, Province of [illegible] Toronto.

here and prosper, or will they slowly drift back to Europe when the war is over?

The answer to this question lies largely with the amount of assistance given to industrial research and institutions for the prosecution of industrial research by the people and government of the countries involved, chiefly the United States and Canada. Canada may

The Late ROBERT K. DUNCAN
A Graduate of the University of Toronto

have a large share of these industries if she will, and it is a problem with which the academic scientist as well as the man of commerce may well interest himself, for along with an increased and successful application of scientific principles to industry will come an increased respect for scientific knowledge in general, and it will be increasingly easy to obtain men and funds for scientific investigations even of the most abstruse and (seemingly) impractical types. To the man of business, it means more and bigger business, more money in circulation and larger opportunities for internal and international trade. To the politician it means increased commercial importance for the nation, conservation of natural resources and solution of many of the problems of industrial unrest that are today ameliorated rather than solved.

How can science and industry co-operate to the best advantage of both parties? The late King Edward said: "The prosperity, even the very safety and existence of our country, depends on the quality of the scientific and technical training of those who are to guide and control our industries." Many years ago Benjamin Franklin uttered similar remarks, when he said that the independence of a country was only assured when its industries were in the hands of men of science. It is evident then, that in the opinion of two statesmen, living in very different times, but possessed of an equal clarity of vision, that there should always be a class of scientifically and technically trained men to take charge of the industries of a country.

How then are these to be obtained, how are they to be supported and administered? Various plans exist. Many large corporations in the United States have, during the last decade, organized large private research laboratories for the solution of their own problems, and placed in charge able men possessed of high degrees from the leading universities of the world. And here I would hasten to distinguish between research laboratories and analytical laboratories. Nearly all firms maintain analytical laboratories for the testing of their products, and important as this is, it must not be confused with industrial research. Only a few firms possess real research laboratories in which a genuine attempt is being made to work out new processes and improved products, utilize by-products and invent new and valuable commodities. The firm doing this on the largest scale in America is the General Electric Company, of Schenectady, but many others engaged in the manufacture of steel, chemicals,

R. F. BACON, Director of the Mellon Institute

rubber, foods, paint, explosives, leather, drugs, and many other things have done so during the last few years with great success.

There are many firms, however, who do not feel that their problems are of sufficient extent, or their resources large enough to found a laboratory of their own, or who do not yet quite trust the ability of chemists and other scientists to solve their problems. But if this could be done at lesser expense by some institution, they would gladly submit a problem to be solved. The possible successful solution of this would encourage them to submit more or to organize their own laboratory. To some extent certain universities have taken up this kind of work, and departments for doing this have existed at the Massachusetts Institute of

Technology and other schools; but it is hard for the university to do such work in a generally satisfactory manner, and it does not seem that such is a practical solution.

Dr. Robert Kennedy Duncan.—It remained for a graduate of the University of Toronto, the late Dr. Robert Kennedy Duncan, to formulate a plan which has excelled all others for making co-operation between the manufacturer and the scientist possible and mutually profitable. This plan is the system of industrial fellowships which has grown into the Mellon Institute of the University of Pittsburg.

While travelling in Europe studying the results of scientific research on the great industries there, the results of which investigations are contained in "The Chemistry of Commerce," Dr. Robert Kennedy Duncan attended the meetings of the International Congress of Applied Chemistry, which was held that year in Rome. During those meetings Dr. Duncan thought out a scheme for the co-operation of learning and industry that has since resulted in a great increase of useful knowledge, and has probably done more than any one other such scheme to better the relations existing between the manufacturer and the scientist who studies the pure science on which industry is based.

The conditions in the United States at the time which made the scheme at all possible of realization were the existence of a high tariff, the growth of monopolies, the existence of enormous quantities of raw materials, a rapidly increasing population and a general intensification of competition in all industries. From his observations, Dr. Duncan saw how, especially in Germany, learning had greatly helped the industrialist in producing a better product and at a price that only the high tariff kept from causing a larger exportation of these goods to the United States and thereby taking the business of many American manufacturers whose methods were wasteful and unscientific in the extreme. If at any time the tariff should be lowered, then the only method by which the American manufacturer could survive would be by efficiency, and to get this efficiency the services of well-trained scientists would be necessary. Nevertheless, if these men were to go to the factory, many difficulties would have to be met. A laboratory would have to be built and equipped, and in many cases the use of a large technical library such as that of the Carnegie Institute in Pittsburg or the John Crerar Library in Chicago, would be indispensable for rapid and accurate advance in research, and would be inaccessible to many of the smaller places in which plants are often of necessity located. A great many other things, such as interference on the part of foremen, would also have to be contended with and would make the position far from an ideal one either personally or from the point of view of its value to the concern.

MELLON INSTITUTE, UNIVERSITY OF PITTSBURGH

The Mellon Institute. On Dr. Duncan's return to America he was able to put the scheme in operation in the University of Kansas, and later in the University of Pittsburg as a department of Industrial Research. Last spring, by a munificent gift by two of Pittsburg's most prominent business men, Messrs. A. W. and R. B. Mellon, the research department was reorganized, and is now known as the Mellon Institute of Industrial Research and School of Specific Industries. A fine new building, now in course of construction, will accommodate about 70 researchers. It will be splendidly equipped with both general and special apparatus and a special library. The Carnegie Library is located in Schenley Park, only a few minutes walk from the Mellon Institute.

The form of contract between the Institute and the company is practically the same in every case, and provides for four parties: the Company, the University, the Public and the Fellow. From the standpoint of the

company, it has proven to be a privilege, and it has been shown many times that it is possible to accomplish results not obtainable in any other way. The Institute is provided with an equipment much larger than is possessed by the laboratories of any but the largest concerns, and in addition, the entire consultative facilities of the University, mathematical, physical, biological, engineering and economic are linked with the work of the Institute. In addition to this the various chemists in the institute co-operate and discuss their work, and thus the company has not merely the services of one isolated chemist, but of a council of expert chemical opinion. Finally, there is freedom from interference, correct judgment of progress made, and an atmosphere of intense research.

Interior views, Mellon Institute, Pittsburgh

The University, on its part, fulfils its obligation of adding to useful knowledge, as the right to publish the results of the investigations at the termination of a reasonable amount of time is assured by the agreement. Also the University is in possession of a large teaching force, as in the agreement the fellows are supposed to give part of their time to lecturing and teaching chemistry. Under the School of Specific Industries one who has had the requisite previous training may be permitted to work and study under an expert in that line.

Great advantage also comes to the public through this system, for every useful fact is of benefit to the public, even though it gets to them through the agency of some company. Indeed, most new inventions and recently discovered knowledge must be taken up and developed by a company if they are ever to do the world any good. If manufacturing wastes were eliminated and scientific principles applied universally, many human needs would be lessened, and in many cases caused to vanish.

To the fellows engaged in these researches, there are many opportunities. They receive a salary according to their ability and training, and are given every chance for real achievement. Finally, if they succeed in a practical manner, they are rewarded by the bonus clause contract with the company. The very reasonable hours of work, liberal vacations and most pleasing relations with the administration, make it a very desirable place to work. In addition to this, there is the fact that while pursuing these researches the researchers instead of being isolated in a purely industrial community, are living in a university atmosphere in a great city with all the advantages of both those sets of surroundings.

At present there are thirty-five fellows actively engaged in the work, and a large advisory staff. The

work has been until recently carried on in a temporary building, with a number of smaller other buildings erected for larger scale operations than it is convenient to carry out in a laboratory room. Some of the problems that at present are being attacked relate to baking, the manufacture of yeast, fats and oils, the abatement of the smoke nuisance, copper, glue, petroleum, natural gas, foods, coating of steel with copper, effect o fa high potential on chemical reaction, corrosion of steel, fertilizers, flotation of ores, aluminum, glass, leather, etc.

The growth is now rapid and steady, and companies are coming continually with problems for solution. After the system was well established, many multiple fellowships were started, in which several men are under the direction of senior fellow, who is responsible to the administration for his juniors. While as yet

The Library

but few results have been published, it may be said that those that have, have been most gratifying. Of course the system could not have grown but on a basis of success. The industrialists have given a most generous trust and co-operation, and have donated much apparatus, and the best proof of the fact that the system has indeed made good is that two such prominent men in American finance have given their money and allowed their names to be used in the title of the Institute.

During the six years of actual working of the scheme, any inherent weaknesses would surely have appeared, had there been any, but such has not been the case. Let us therefore look over the system as proposed by Dr. Duncan in the North American Review for May, 1907 and subsequently in his book, "The Chemistry of Commerce," before any experiment of the kind had been tried. Then let us read his account in "Some Chemical Problems of To-day" of the work after the lapse of four years, and finally let us go through the Mellon Institute as it now is, and we will be surprised to see with what clearness the whole thing was thought out before a single fellowship was established, for in all but a few minor details it is in operation just as it was proposed over six years ago. It is an astonishing and an almost incredible thing.

To-day the Mellon Institute offers a sensible, practical scheme for the betterment of industry, the placing the university on a higher plane of usefulness, and the advance of knowledge and the public good.

That Canada has problems to be solved is not a matter of dispute. To-day people are wondering why so few metals are refined in Canada, and why it cannot be done profitably here. The question is not merely a political, but a chemical one as well. We need to know how to utilize the Canadian iron ores, how to utilize the waste of the wood pulp industry, how to utilize a hundred and one now unused natural resources.

There is no doubt that the encouragement of scientific research that could not help but result from the establishment of one or more institutions similar to the Mellon Institute of Pittsburg in Canada would be of the greatest benefit to Canada and also to all the universities in the country. Whether it will be done now, when the need is great, or not, depends on whether the people think it worth while to keep their native scientific talent in Canada or allow it to wander away to other countries. For the man who feels that research is his life-work will go where research is appreciated and honored. In every research institution in the United States are Canadians who, when asked why they left the land of their birth, invariably reply, "What was there for me to do in Canada?" The work these men have done in America, in Great Britain and in other foreign countries is ample evidence of what they would have done for their own country had their countrymen set them to work. It is not too late now to remedy this condition; this period of change and alteration in the commercial conditions of the world affords an opportunity to make a new start that will never come again. Will it pass unused?

According to Mining and Scientific Press, copper is said to be produced at the Kennecott mine, Alaska, for five cents a pound. The record of the previous decade was the seventeen cent mine of the Wolverine in Michigan, but there the cost has risen to eight-and-a-half cents. The big disseminated copper deposits lowered the record, notably the Utah Copper, later the Chuquicamata of the Chile Copper Co.) took the palm for cheapness, at under six cents a pound.

Coal Age, New York, recently included in its personals the following items: Lowther Ferris, formerly general sales agent of the Wellington-Comox Agency, Ltd. (Canadian Collieries, Dunsmuir, Ltd.), of Victoria, B.C., has organized and will manage a coal business in the Columbia River Coal Dock Co., of Portland, Oregon. Docks, docks for coal storage and ship loading are to be erected at once on North Portland Harbor. Irving R. Gard has been appointed consulting engineer for the Columbia River Coal Dock Co., of Portland, Oregon. He will design and superintend the construction of the coal hoisting and storage docks which this company will erect at once on the Columbia River near North Portland. The plant, when completed, will be the largest and most efficient in the Pacific Northwest.

MINING SCHOOL OF THE CLEVELAND-CLIFFS IRON CO.*

By C. S. Stevenson.

The Mining School of The Cleveland-Cliffs Iron Company is of that class of trade schools known as Industrial Corporation Schools, the purpose of which is the mental improvement of those already enlisted in the industry. There are but a very few of this general type in the United States and each is operated on a plan peculiar to local conditions, the one thing in common being that the work taught is in harmony with the industry concerned. A great many such are operated in Germany and by many they are credited as being largely instrumental in producing the great industrial development of that country during the past twenty years.

The Purpose of the Mining School.—It is essentially true that the foreign labor which has been absorbed in large numbers by our mines in recent years is an inexperienced product. It is, however, not the purpose to attempt to teach these men (except in unusual cases) since by difference in language and a lack of early education they are not amenable to school work of this character. The prime function of the school is to train to the highest possible degree of efficiency the English speaking men upon whom this inexperienced foreign product depends for its guidance. The school, therefore, is not open to all underground employees of the company, but concerns itself only with a group of men who are carefully selected by the superintendents and mining captains on a basis of their ability and mining aptitude.

Before instituting the work a serious effort was made to locate and study the method of operation of similar schools so that the common elements of these might be taken as a frame-work around which our instructional work might be constructed. This investigation proved that there were none in the United States the aims and purposes of which were at all similar to the one we proposed to establish. Investigation did, however, indicate that a school in its ordinary sense and our Mining School should be very dissimilar in their aims and purposes. The public ones have for their purpose a broad, mental and cultural development. The Mining School, on the other hand, while not ignoring the desirability of such instruction, largely disregards the curriculum and methods thereof and concerns itself wholly with instructional work calculated to increase the workman's efficiency and co-incidently his earning capacity. In short, it is designed to have a definite value in dollars and cents, not only to the miners who participate in the work, but to the company as well.

Attitude of the Men Towards the School Work.—In the beginning it was noted that the men were as a rule indifferent, if not antagonistic. Attention, however, should be directed to the fact that a few men of especial ambition and energy welcomed it, several of whom had already attempted to help themselves through the medium of the correspondence schools. Some, however, looked upon the work with a suspicion that it was intended to benefit the company and not themselves. They felt that their minds and bodies were in a rut and that the company was arrayed against them. Gradually, but not without difficulty these prejudices were broken down and replaced with a spirit of open-mindedness and enthusiasm. The company has authorized the statement that in so far as possible all men chosen for shift bosses will be taken from the ranks of the Mining School. This gave the men a definite motive for attendance and interest and assisted greatly in quickly breaking down all prejudices, since it proved that the work was an undertaking of mutual concern to the company and miners as well. On June 1st, 1915, the work of the first class, comprising 33 men, was completed, and it can be stated definitely that for the greater period of their course the men manifested a higher degree of open-mindedness and enthusiasm than is usual in high schools and universities.

Time Given to the Course.—The students enrolled in our school are largely men with families and ordinarily quite a large portion of their leisure time is given to domestic affairs. The school intrudes on this and it would be unreasonable to suppose that the men would willingly sacrifice this time from their home affairs for a long period. For this reason the work of a single class is designed to cover one and a half years. This length of time proved, if anything, too short for the instruction in the subjects covered by the course, but this was overcome by the simple expedient of increasing the length of class periods and also the amount of home preparation.

Each miner according to our present system attends two classes a week, each of an hour and a half. If the miner is working on the day shift he attends the evening classes and if he is working on the night shift he attends the afternoon sessions. All of the class work is done on the miners' own time and they receive no remuneration from the company for that given to the school work.

Readiness With Which the Men Acquire Information.—The experience gained with our first class proved that the men can readily assimilate information if care is always taken to bring out the practical application of the instruction to their daily work. For example, a course in arithmetic would be a failure if taught as an abstract subject, but if the instruction is prepared with a view to its practical application to the daily problems of a miner's life, the student is interested and for the first time sees the purpose of the instruction which bored him in his early school days. In short, the power to assimilate information is in direct proportion to the practical value of the instruction. The men have a skill derived from long experience in mining and can perhaps more readily assimilate academic instruction relating to the industry than can the average university student lacking such experience. However, in their ability to comprehend abstract information they rank considerably under the students of the high schools and universities.

Factors Controlling Attendance.—The Mining School of our company began its first class with an enrolment of 38 men and of these, 33 successfully completed the work offered by the department. Four of the five men, who began but did not complete the course, withdrew from the work on account of business conditions, which made their attendance impossible. We are very proud of this record of attendance since we have had a much lower rate of attendance mortality than has been reported by similar schools in the United States. Many devices were resorted to for the maintenance of attendance. First of all, a high degree of personal friendship was established between the students and the instructor. In all cases it must be borne in mind that

*Paper prepared for the Twentieth Annual Meeting of the Lake Superior Mining Institute, held in the Gogebic and Crystal Falls Ranges, Sept. 6th to 9th, by C. S. Stevenson, Educational Director, The Cleveland-Cliffs Iron Co., Ishpeming, Mich.

the men are not children, but of mature years and respected in the communities in which they live, and great care is taken not to wound their pride and self-respect. Infinite patience must be a virtue of the instructor to an even greater degree than is common to the teaching profession. In case a student grows discouraged and fails to attend classes, an encouraging letter is sent to him together with a copy of the instruction paper for the succeeding lesson, and upon his return to the class room an increased amount of personal attention is given until he again feels that he is on a par with the other men. In so far as possible the formal atmosphere of the ordinary class room is avoided and replaced by conditions calculated to make the men feel comfortable and at home. Illustrations in lectures are taken whenever possible from the experience of our own company which gives the men a personal interest in the subject under consideration. In short, a feeling of fellowship and confidence must be created early in the work, after which many problems may be ironed out satisfactorily.

System of Instruction.—We have adopted with success what is known as the "Unit Course," in which the entire attention of the men is fixed on one subject until its completion. Experience has proved this system to be much better adapted to our needs than the teaching of several subjects coincidently.

As a nucleus for each course, instruction papers have been prepared in either mimeographed or printed form. These instruction papers become the property of the men and form a convenient means of reference in the future. They are, however, but a minor part of the instruction, most of which is imparted by lectures.

Development of Independent Thinking.—The experience gained with our first class has proved that perhaps the greatest weakness of the men is in their lack of power to do original and independent thinking. To correct this mental condition a series of informal discussions on mining topics was instituted early in the course. These were not a scheduled part of the course and they followed the usual class period, the discussion being led by the instructor. This interchange of ideas broadens and helps the men and is perhaps as large a factor in the production of a man of reliability and common sense as is the pure school work itself.

Topics Discussed.

Mention of a few of the topics discussed is given herewith:

Safe methods of blasting down timber.

Methods of thawing dynamite.

The use of delay action fuses in shaft sinking.

The location of holes in blasting various types of ground.

The choice of explosives for different character of ore and rock.

The proper methods of charging and tamping explosives.

The choice of drilling machines for different classes of work.

The elementary features of rock drill construction.

The care and use of rock drills.

The proper methods of setting timber and the variety of timber to use in cribs and logs.

The advantages of systematic sub-level work over unsystematic sub-level work.

The relative merits of timbered and untimbered raises.

The proper thickness of a sub-level slice from the standpoints of safety, costs and recovery.

The inspection and lubrication of hoist ropes.

The testing of safety catches on cages.

The cost of producing compressed air.

Underground sanitation.

Ventilation of metal mines.

The sampling of ore and its relation to the marketing of ore.

The proper degree of discipline of the shift boss over the miner.

Methods of procedure at mine fires.

The treatment of a man overcome by powder smoke and other first-aid problems.

The Workmen's Compensation law.

The proper use of the various report blanks which are filled out by underground employees.

The informal discussions above referred to were valuable, but experience proved that a few of the men had hesitancy in expressing their ideas. To reach these men we began our monthly "Suggestion Papers." These involved the preparation by each student of an essay on any mining subject of his own choosing, once each month. In the preparation of these the services and advice of the instructor were freely given. A high standard of neatness and accuracy was demanded. The papers submitted were of an unexpectedly high degree of merit and they indicated a very laudable desire on the part of the men to do real, independent thinking. They as well had a secondary value in the development of penmanship and in the use of the English language. It can be definitely stated that, as a result of this effort to mentally awaken the men, there was a marked improvement shown in their ability to do original thinking and in their power of analysis.

Age, Nationality and Previous Schooling of the Students.—The average age of our first class was 32 years at the time of beginning the course. The youngest student was 22 and the oldest 50 years of age.

The nationality of the men was as follows:

American born	13
English born	12
Finnish born	1
Swedish born	2
Italian born	2

The average number of years spent in school previous to attending the Mining School was 4.3 years. The range of time previously spent in school varied between two months and 10 years.

What Should Be Taught in a Course of This Character.—Since the time spent in the work is small it is evident that only such subjects should be taught as are of practical value to the student in procuring his advancement. It is better to teach a few subjects thoroughly than to teach a smattering of a large number of subjects. In the choice of these the limited early preparation of the men cannot be ignored and any tendency to introduce university or even high school standards must be carefully avoided. In order that the instruction in a school of this character may be sufficiently effective to justify company approval and subsidy, two principles must be adhered to: first, course of study should be developed from mining situations and be adapted to mining needs; second, the actual employments of the men should be investigated and analyzed in a search for the common elements on which group teaching can be based. The following course was followed by our first class, which completed its work June 1st of this year. It is designed to cover fundamental subjects as a basis foundation the student can build after he leaves the school. Each of the subjects was taught in the order in which it is [illegible]

named: 1, arithmetic; 2, elementary drawing; 3, geometrical drawing; 4, mechanical drawing; 5, geology; 6, construction and use of mine maps; 7, first-aid to the injured; 8, time-keeping; 9, mine sampling; 10, mining methods; 11, business correspondence.

Detailed Review of the Work Taught.

Arithmetic.—The instruction in arithmetic has for its object primarily to impress on the men the necessity for acquiring a thorough system of making, with as much self-dependence as possible, the more simple calculations relating to the wages of miners, costs of mining and estimates. A total of 18 special instruction papers were prepared for and used in this work. These papers were designed, in so far as possible, to cover the needs of the mining industry. The parts of arithmetic treated were: Addition; subtraction; multiplication; division; cancellation; addition of fractions; subtraction of fractions; multiplication of fractions; division of fractions; addition of decimals; subtraction of decimals; multiplication of decimals; division of decimals; percentage; proportion; areas of surfaces; computation of volumes; powers and roots.

As indicating the difficulty which we encountered in the instruction in this subject it may be said that no more than five of the men had ever completed a course in arithmetic and there were many who in the beginning could not make the simple computations in addition and subtraction.

Elementary Drawing.—Drawing is the sign language of the mechanic. In discussing a practical problem the first thought of the shift boss and the mining captain is to make or attempt to make a sketch. Modern mining development demands that the shift bosses and captains be able to understand and work from blueprints. For these reasons the subject of mechanical drawing was taught in the Mining School. In elementary drawing five simple drawings were made by each student which served largely to accustom them to the use of drawing instruments and the fundamental principles of making a drawing.

Geometrical Drawing.—This course has a two-fold value: first, it serves as a preparatory subject to mechanical drawing and, second, it gives the student a working knowledge of geometrical facts which have many common and practical applications. A total of four drawing plates, covering 24 geometrical principles were required in this course.

Mechanical Drawing.—In this subject each student completed five drawings, beginning with simple mechanical devices and proceeding to more complicated work. The prime purpose which was to teach the men how to read a mechanical drawing, was accomplished. The character of the work done by the men in this subject was of an unexpectedly high degree of merit and closely approached the work of similar nature which is done in universities. The interest which the men took in it was manifested by the fact that the majority of them have purchased mechanical drawing instruments for their own use. A considerable amount of interpretation of blue-prints was required of the students in connection with this work.

The course in mechanical drawing had a secondary value in the development of system and accuracy. In the beginning the men were found to make numberless mistakes in measuring dimensions and in the details of construction. Gradually, however, these faults were overcome and the men accustomed themselves to think and work accurately.

The work taught in elementary, geometrical and mechanical drawing is based on a printed instruction paper written for the especial needs of the Mining School.

Geology.—In so far as possible all instructional work in this subject is based on the geology of the Marquette range. A printed instruction paper is used as the nucleus of the course and with our first class this was supplemented by lectures and the study of approximately 150 specimens of rocks and minerals. The men took a very lively and almost unexpected interest in this subject. It was found that some of the men had a fairly good idea of the geology of the range in the beginning and these welcomed the opportunity of perfecting the information which they had gained largely through practical experience. Many of the men it was learned have mineral collections in their homes and many specimens of rocks and minerals were presented to the instructor for identification and discussion. It is believed that there is no course more valuable than geology in making a miner's work more interesting and less of a drudgery. The course followed the following outline:

Dynamical Geology.—1, The effect of the atmosphere on rock formation; 2, the decay of rocks; 3, the formation of sedimentary rocks; 4, aqueous agencies; 5, mechanical effects of water; 6, the formation of water falls; 7, the eroding power of streams; 8, the formation of deltas; 9, the action of glaciers, especially on the geology of the Marquette range; 10, chemical effects of water; 11, chemical deposits from springs; 12, the condition of the interior of the earth; 13, the effects of heat on rock formation; 14, organic agencies; 15, the formation of coal and limestone.

Structural Geology.—1, Exposures of rock valuable for study; 2, definition of the term "rock"; 3, classes of stratified rocks; 4, dip of rocks; 5, the outcrop of rocks; 6, anticlines, monoclines and synclines; 7, conformability of rocks; 8, fossils; 9, igneous rocks; 10, igneous rock classification; 11, metamorphic rocks; 12, structure common to all rocks; 13, joints in rocks; 14, fissures; 15, normal faults; 16, reverse faults; 17, forms of ore bodies; 18, definition of "ore"; 19, discussion of the form in which ore bodies occur on the Marquette range.

Historical Geology.—1, Discussion of the geological section; 2, discussion of the succession of rocks on the Marquette range; 3, detailed description of the rocks of the Marquette range, illustrated by specimens.

History of the Marquette Range.—1, Date of discovery and record of development; 2, history of the Swanzey range.

Iron Ores.—1, Discussion of the composition and the characteristics of various iron ores; 2, discussion of the ores of the Marquette range; 3, the use of the dip needle in the location of ore bodies; 4, the occurrence of soft and hard ores; 5, a detailed description of the ore deposits at the Maas, Negaunee, Austin, Stephenson, Lake and Cliffs Shaft mines.

The Construction and Use of Mine Maps.—In this course it is desired to teach the fundamental details of map construction with a view to facilitating the student's interpretation of the maps supplied to him by the engineering department. The experience of our engineering department indicates that there is a definite need for instruction of this character. The course is based on a mimeographed instruction paper which follows the outline given below:

A.—The Use of a Compass.—1, Description of compass; 2, degree of accuracy secured in compass work—magnetic attraction; 3, the reason for reversing the east and west points of a dial on the compass; 4, the method of procedure in using a compass; 5, problems illustrating the use of a compass in sub-level work.

B.—The Use of a Clinometer.—1, Determination of the angle for putting up a raise and use of the lines given for a raise by the engineers.

C.—Templates for Track Curves.—1, The grades of tracks; 2, use of a hand level and track level.

D.—Description of the Protractor and Engineers' Scale.

E.—The Construction of Maps.—1, Co-ordinates; 2, the relation of the co-ordinates of a sub-level to those of the sub-level above and below; 3, the scale of mine maps with sufficient problems to enable the students to take distances from maps; 4, the zero point or origin of a survey; 5, Government surveys; 6, the explanation of the use of cross-hatching in constructing mine maps, also coloring; 7, problems in mine mapping.

F.—Mine Levels.—1, Sea level datum; 2, the use of an arbitrary datum plane; 3, the proper use of elevations, supplied by the engineers, at the top of each raise. The disadvantages of having sub-level drifts meet off level.

G.—General Consideration in the Use of Mine Maps.—1, Systematic sub-level work in relation to efficiency in handling timber and supplies; 2, the relation of systematic sub-level work to maximum recovery of ore; 3, the relation of systematic sub-level work to the safety of miners and its relation to the ventilation of a sub-level; 4, procedure in locating a block of ore which has been lost on the sub-level above; 5, assay maps and their use; 6, use of maps in holeing into or connecting with other workings, whether abandoned or where men are at work.

First-Aid to the Injured.—The work of first-aid to the injured has taken a place of such importance in mining that it would seem unnecessary to elaborate on the reasons for including instruction thereon in a course of this character. This work was given through the medium of lectures, which followed the following outline: 1, The history of first-aid work and its aims and purposes; 2, the structure of the body; 3, description of the various types of bandages used in first-aid work; 4, description of wounds and prevention of infection, the treatment of shock and the use of stimulants; 5, the circulation of the blood and the control of hemorrhage; 6, bruises, sprains, dislocations and burns; 7, the treatment of fractured bones; 8, respiration and the standard methods of inducing artificial respiration.

Time Keeping.—In view of the fact that our company is selecting its new shift bosses from the ranks of the Mining School it is important that the students be instructed on the methods of time-keeping. This subject was presented to the students in the form of a mimeographed instruction paper which explains in detail the system of time-keeping used by The Cleveland-Cliffs Iron Company.

Mine Sampling.—The instruction in this subject followed the outline given below:

A.—Theory, and importance of close attention.

B.—Methods of application in use by The Cleveland-Cliffs Iron Company in: 1, Drifts; 2, stopes; 3, raises; 4, mine cars; 5, skips; 6, railroad cars; 7, steam shovel loading; 8, stockpiles.

C.—Treatment of Samples.—1, Labeling; 2, crushing and drying; 3, quartering; 4, bucking-down.

Mining Methods.—This subject was presented to the students in a mimeographed instruction paper covering the methods of mining common to the iron ranges of the Lake Superior district. The course followed the following outline:

1.—General principles governing the selection of a mining method: (a) Open cut mining; (2) steam shovel mining.

2.—Method of mining medium and hard ores: (a) Milling; (b) underhand stoping; (c) back stoping, Case 1 and 2; (d) back stoping, Case 1 and 2; (e) substoping.

3.—Method of mining soft ores: (a) Room and pillar square set; (b) room and pillar square set using filling; (c) top slicing one set high; (d) top slicing two sets high; (e) sub-caving, Case 1 and 2.

4.—Detailed description of the methods of mining used by The Cleveland-Cliffs Iron Company in the Negaunee, Ishpeming, North Lake, Republic and Gwinn districts.

Business Correspondence.—In view of the student's inexperience in business correspondence it was thought advisable as a final course to instruct them in the art of writing a good business letter. This subject was presented to the students in a mimeographed instruction paper, each student being required to write at least twelve business letters which were graded by the instructor for neatness and their conformability to established forms and customs in business correspondence.

Instruction of Mechanics and Electricians.—This paper would not be complete without mention of the educational work which is being done by our mechanical and electrical departments. In this work engineers act as instructors and any employee engaged in mechanical or electrical work is privileged to attend the classes. Evening classes only are held, the men receiving one lesson each week. The work is very practical in its nature and excellent results have been obtained.

This paper is presented as a record of what has been accomplished thus far by the educational department of our company. We realize that the plan here presented can be improved upon and certain improvements are already under consideration. Whether or not the school is permanent may be safely left to the future. At present it meets an urgent need and will until co-operation with the public school can be effected.

STURGEON LAKE.

For some time the St. Anthony mine, now in the hands of Mr. Geo. Glendinning of Toronto, has been under option to interests identified with the Kerr Lake mine. It is probable that the option will be taken up.

LA BELLE KIRKLAND MINES, LTD.

The La Belle Kirkland Mines, Ltd., has been formed to take over the Gibson claims in the Goodfish Lake area. Very good results have been obtained in exploratory work and machinery is being taken into the property and camps being built.

WEST SHINING TREE.

The Canadian Copper Co. has taken over from Smith & Durkee, Sudbury, the option on a copper deposit in the Township of Commanda. The location is west of the West Shining Tree district in which several gold discoveries have been made.

ZINC CONCENTRATES IN THE PRIZE COURT

The "Mining Journal," London, under date of September 25th, says:

Several cases arising out of shipments of zinc concentrates from Australia, either captured or diverted to English ports as a result of the war, were heard by the President of the Probate, Divorce, and Admiralty Division of the High Court during the current week. In all there are five cases to be tried, involving something like £1,000,000. During the course of the hearing much important information as to the interrelation of various firms connected with the zinc industry was disclosed. The circumstances with regard to the various ships concerned vary. Where the consignments were, on the face of them, to Aron Hirsch & Sohn the property was condemned, but a lengthy argument was addressed to the Court, both on behalf of the Crown and on behalf of the firms concerned, with regard to parcels claimed by Messrs. Henry R. Merton & Co., Messrs. Vivian, Younger & Bond, the Australian Metal Company, and the Compagnie des Minerais. The Solicitor-General argued that the charterers were the Metallgesellschaft, and that the Australian Metal Company and the Compagnie des Minerais were its puppets. From the correspondence it was to be inferred that the Australian company purchased the concentrates on behalf of the Metallgesellschaft, which took entire control of the sale of the lead concentrates, and merely informed their English partners of what had been done. The so-called British firm, Henry R. Merton & Co., with its intimate German commitments and German origin, came to ask the Court to help it to set up a partnership in a business mainly carried on in an enemy country.

Mr. Maurice Hill, K.C., for the claimants, said this was no question of trading with the enemy, as it was concerned with shipments made before the war. The only question was as to the enemy or non-enemy character of the goods. The Solicitor-General had referred to a German octopus which had spread its tentacles over the metal trade of the world, but it would be just as true and just as false to say that an English octopus had spread its tentacles over the German trade. Mr. Merton started the London business of Merton & Co. in 1860. He was born in Germany of English parents, and in 1899 or 1900 H. R. Merton & Co., Ltd., was formed. Mr. Merton had carried on business in England for 20 years before the Metallgesellschaft was formed in Germany. That was also a company in which Mr. Merton was interested, but to represent the whole concern as a German firm which was gradually, by means of subsidiary companies, getting its grasp on the metal trade of the world was wholly misleading. The majority of the shareholders in H. R. Merton & Co., Ltd., were English. Of the directors all except two were British. The Metallgesellschaft was formed in 1882, and the directors of H. R. Merton & Co. were the holders of a very large quantity of the shares. One shareholder, a Mr. Zuny, who died a short time back, by his will left the income on 300,000 shares to British charities. The firm of Vivian, Younger & Bond was a partnership firm. At the beginning of the war two of the partners were British born, and the third, who afterwards resigned, was a naturalized British subject. As to the Australian Metal Company, the shareholders in the majority were German—26,700 out of 50,000. The directors also at the beginning of the war were in the majority Germans—four against three. The Campagnie des Minerais was formed in 1900, and of its shareholders about 60 per cent. were German and the rest mainly Belgian and French. As to the Ore Trading Company, which came into the matter as merchants for dealing with certain ore on behalf of all these companies and firms, the large majority of the shareholders were British, American and German. He submitted that the evidence showed that the property in the zinc concentrates in question was in the Compagnie des Minerais, and the property in the lead concentrates was jointly in the Metallgesellschaft, H. R. Merton & Co., Vivian, Younger & Bond, and the Australian Metal Company. Therefore, applying the test of property, the proper order to make was to release the zinc concentrates altogether and to release the lead concentrates as to three-fourths and to condemn it as to one-fourth—the fourth share belonging to the Metallgesellschaft.

At this point the Solicitor-General interposed as a witness as to the constitution of the Compagnie des Minerais Mr. J. C. Van der Taelen, a Belgian managing a leading Belgian metal company in Antwerp, but at present connected with Messrs. Peters & Co., of London. He stated that the company did not smelt or work the zinc, but sold the ore to the smelters and bought back the metal produced. So far as he knew most of the directors were associated with the Metallgesellschaft, and the company was practically a German one.

In the course of cross-examination, Mr. W. M. Wilson, a director of Messrs. Henry R. Merton & Co., stated that his firm acted as bankers for the Australian Metal Company and the Compagnie des Minerais, and that the Gesellschaft supplied them with money to meet these charges. Since the war they had received no remittances from the Continent, and he feared at the end of the war it would be impossible for Germany to remit in full, if at all.

Further hearing was adjourned.

GRANBY.

In the annual report of the Granby Consolidated Mining, Smelting & Power Co., President Nichols says:

"Results so far attained confirm our belief previously expressed that no insolvable problems exist with respect to operations of the new properties, and while those results are highly gratifying, it is reasonable to expect that considerable progress will yet be made in the line of further reduction of costs. Fundamental conditions, both as to property and organization, continue highly satisfactory."

Following is a statement of ores treated in the year ended June 30:

	Tons Ore Smelted.	Recovery per ton ore. Copper (lb.)	Silver (oz.)	Gold (oz.)
Phoenix	611,097	16.12	116,752	23,855
Anyox	462,340	34.58	142,725	3,581
Total	1,073,437	23.99	259,477	26,936
Ores purchased	24,583	.....	118,404	4,452
Total	1,098,020	.....	377,881	31,388

During the year development at Phoenix mines added 152,872 tons to reserves, which stood at 4,232,405 tons at end of the year. At Anyox little development was done, but 187,500 tons of 2.2 per cent. ore were added to reserves, making the total 9,205,837 tons. There is a further tonnage of low-grade ore (.63 per cent. copper) amounting to 8,628,000 tons. In addition, the Bonanza mine has 414,775 tons of 2.66 per cent. ore and 489,580 tons of low-grade ore.

Of the Anyox smelter the report says: "The plant, originally designed to treat 2,000 tons of Hidden Creek ore per day, has been well arranged and constructed for the economical treatment of these ores.

THE LANE THAT HAD NO TURNING

By J. H. Patterson.

After dinner we adjourned to Strange's smoking room and over our cigars were discussing the influence of luck or chance on the affairs of men.

"Good fortune follows some men all through life," remarked Ganes, "and no matter what apparent disaster happens them it works to their advantage in the end."

"Every cloud has its silver lining," quoted Wilson, "and it's a long lane that has no turning. It is evil and good to all, just like the weather."

"I don't agree with you," replied our host, "but I suppose that you will think it heresy to contradict such ancient maxims." He went to a cabinet and brought out a beautiful lump of silver ore about the size of his fist; it was easily three-fourths metal. It was passed around and admired by all.

"Of course there is a story," I queried.

"Yes," he replied, "there is a story, and I will tell it just to prove that those wise old saws are not always correct."

"You all know the Mathews mine," he continued, "out of which I took over fifty thousand dollars worth of silver ore. Unfortunately it did not carry values to depth, but none of you know how it came to be so called.

"James Mathews was a typical prospector, rugged, raw-boned and muscular, bearded and browned by exposure to many suns. He had been in South Africa and Australia, and had spent several years in the Yukon; but had never made a discovery worth recording.

"Cobalt was just beginning to attract the attention of the world and mining men were flocking in from every quarter. Among them came Mathews, in the hope that silver might change his luck. But he was dead broke, and a friend of mine to whom he applied for a job passed him on, so he came with the request that I grubstake him, and so won me by his honesty and simplicity that I sent him north with an outfit and provisions for three months. We made an agreement to the effect that we were to share alike in any discovery he might make.

"It sometimes happens that when a man has been sent out to prospect with outfit and supplies, paid a salary and given an interest in any discovery he may make, that he will put in most of his time in the nearest hotel or good camping place and do no work whatever. I have known this to happen in more than one case.

"More than three months had passed and no word came of my prospector. One day the office boy informed me that a very ragged beggar wished to see me and would not be denied. I told him to bring him in. It was Mathews and ragged he certainly was.

He laid the piece of ore you have just examined on my desk without a word. I was astonished at its richness.

"'Well, Mathews,' I said, 'your luck has surely changed. If you have found more of this——'

"'It has and it hasn't,' he replied. 'I found a beautiful three inch vein of it but lost it again.'

"'I went out as soon as I arrived in the country and worked hard as long as the grub lasted. On my way out for more I crossed a small valley. The valley wall was steep and there was a little stream at the bottom. As there was water I thought that I might make some tea. I had nothing to eat. Filling my can I went up to a little knoll some sixty or a hundred yards from the stream to make my fire. As I was breaking a dead branch with my axe I accidentally scraped the moss off the rock and exposed the silver. I pulled away the moss for some distance and the vein was clear and well defined. You can imagine how delighted I was. After fifteen years of hard work I had made good at last. I did not stake as I had no food, and supposed that I could come to the place without difficulty, as I thought that I was only one day's trip from the village. I blazed an occasional tree as I went along and noted the country carefully.

"'I had no compass with me, and as the weather was dark and rainy I got completely lost. It was not until late on the third day after making the discovery that I reached civilization.

"'I was entirely played out, but as soon as I was able to travel I started back to where I had been working and tried to come out on my trail. I did not succeed in finding the place again, though I have been traveling the country from daylight till dark ever since, so you see that fortune has played me the most scurvy trick of all.'

"I encouraged him to hope that he would soon find his discovery again and sent him back with enough supplies to carry him on till winter. I also sent a young fellow up with him, but he was back at the end of less than two weeks declaring that he would not work with a man who got out at daylight and traveled as long as he could see and made camp after dark.

"I heard from Mathews once, and it was not a very hopeful letter, but it was not until winter was well advanced that he came down and reported. He had not succeeded and was much cast down in consequence. The hard work he had done had told on even his rugged constitution, and he was thin and ill.

"'I'll have another try in the spring,' he said. 'I can't be far from it now. I am dividing a block of country about six miles square by blazed lines into small areas and going over every inch. I am more than half done. I feel sure that it is somewhere within that thirty-six square miles.'

"I got him a good job here and saw him often. Always he would mention the location of the vein.

"'One wall of the valley,' he would say, 'is quite steep and about thirty feet high. At the bottom is a small stream, which would likely be dry in summer. The [illegible] is not more than a hundred yards from the stream. It is covered with moss and the vein is there that will make us both rich.'

"He could talk of nothing else, and it seemed to me that his anxiety to make good came from a wish to know that fortune was really smiling on his as much as a desire for wealth.

* * * * *

"Well spring came at last and as soon as the snows had melted in the north [illegible] Mathews.

He was as happy as a [illegible] boy at [illegible] and felt sure that he would soon make good. I wanted to send a man along with him, but he preferred to work alone. He said that he would not [illegible] till he had some more grub and it was in July when I first heard from him. He had found some of the trees which he had blazed and was now sure of finding [illegible] not be simply [illegible] again.

[illegible] from this [illegible] to [illegible] [illegible] asking him to [illegible] Mathews [illegible]

see him, and for him to advise me and remain there till I arrived.

"Early in September I wrote again and was informed that nothing had been seen of Mathews. Fearing the worst I went north. They knew him, but did not know the country in which he was working, as he never talked. As I had a general idea of where he might be I sent two men out to search for him and kept them there till winter, but they found no trace of the missing man.

"Mathews must have been very ill when he made his last trip for supplies; but believing that he was near the goal he would not give up, and going back had become worse, and so was unable to get out.

"I determined that I would find him if it was at all possible and give him a decent burial. I had become quite attached to the old fellow and of course I was quite anxious to find the silver as well.

* * * * * *

"Early next spring I had to make a trip to England, and it was June before I returned. I had a lot of business to attend to, and it was some time before I thought of Mathews. Then as I was going north I thought I would send men out on the search.

"The day before I intended to leave a man came into the office and handed me a roll of birch bark."

From the same cabinet Strange took out the roll from which he read:

"To whoever finds this, please deliver to the below address and oblige a poor prospector who is about to die. Leave me where I lie as I want the man to whom you deliver this to bury me."

"Inside was written: 'Dear Friend,—I am too weak to walk, and think that I am near my end. I have no relative that I know of, so I leave all my property to you on condition that you come up and bury me. I made my camp on a rocky knoll so my bed is hard. I should have made it in the valley by the water.

"Good-bye, good friend, and may you live long to enjoy the wealth I leave you, for me fortune still wears a frown."

"Crazy as a loon," remarked the prospector who had evidently read the letter. "He has divided the country for miles into squares of about a quarter of a mile each by blazed lines and one of them led us to his last camp. Lord knows what he thought he was doing. And then the wealth he was leaving you, I suppose he just imagined it."

"Poor old chap," I said, "it was hard to die there alone, but he was a good man and true, and I will go up and bury him. I suppose you left him as you found him." For I understood his letter at once.

"Sure we did," he replied, "and you will want to hire me to take you in."

"Certainly I will," I assured him, "and pay you well for coming down, too."

* * * * * *

In company with a friend and guided by the prospector, I set out. After a trip of two days we arrived at the valley for which poor Mathews had so long sought.

Sure enough the tent was pitched on a knoll about ten feet high. There was the valley and the little rivulet. All just as he had described them.

We dug him a grave in a little shady nook under a large birch some distance from the knoll and fenced it in with logs.

I took down the tent and removed the brush which he had for his bed. Underneath it lay the vein.

THE RECENT GOLD DISCOVERY AT KOWKASH, NORTHERN ONTARIO

By J. A. MacDonald.

The recent discovery of gold at Kowkash is especially interesting to me, for I was among the first to find traces of gold in that district. In 1905 and 1906, I was engaged in surveying the line for the new transcontinental railway north of Lake Nepigon and through the Kowkash country. The line as now constructed was laid out by our party.

With our party in 1905 and 1906 was a man who came with us principally with a view of prospecting the country. He had spent many years in gold mining in a small way along Sturgeon Lake, a hundred miles or so farther west than Kowkash. Gold mining at Sturgeon Lake has been in progress in a small way for many years. While prosecuting our surveying work and endeavoring to obtain a good preliminary line for our railway, we traversed much of the country to the north and south of the located line, and in our reconnaissance we frequently came across rock containing gold. I recall that in the vicinity of what is now called Kowkash, Mr. Frappman, the man I referred to, brought me in specimens of rock containing gold. Though the gold could be distinctly determined by the naked eye, we utilized the magnifying glasses of my transit to more readily form an idea of the value of the specimens. I took the magnifying glasses used to read the vernier of the transit, and my friend had the use of this glass for studying the specimens. I mention those facts with some little pride, and in confirmation of the truth of this recent discovery. Gold there is in the vicinity of what is now Kowkash station on the N. T. Ry.; but as to its paying qualities, or to the richness of the quartz, I have no knowledge.

All of the country directly north of Lake Nepigon contains outcrops of rock. In our work on the railway scarcely a week passed in the summer season but some specimens supposed to contain traces of gold were brought into camp. To get into that country in 1905 was a pretty difficult matter. The only route at that time, and before the N. T. Ry. was completed, was by way of Nepigon River and Lake Nepigon by canoe, and portage in summer and by dog-train in winter. By the zig-zag route we were forced to take it was an eight-day journey from Nepigon station on the C. P. Ry. to the neighborhood of Kowkash. To-day it is less than a two days' journey from Ottawa or Toronto or Winnipeg, all-rail route to within thirteen miles of the gold fields.

JEFFREY MINE FANS.

The Jeffrey Manufacturing Company, manufacturers of Tipple and Mine Machinery, have issued Bulletin No. 110 on the subject of Mine Ventilation, calling particular attention to their new "Stepped Multi-Bladed Wheel Type of Fan," which, by means of its stepped series of blades, receives and accelerates the air without shock and discharges it at low velocity, insuring maximum economy of operation. This bulletin also illustrates and describes their line of Centrifugal Booster Fans, and contains valuable data compiled to give the mine superintendent, manager or those interested in this line of work a comprehensive idea of the results obtained from various sizes of Jeffrey Mine Fans.

A free copy of this bulletin may be obtained by addressing the Jeffrey Manufacturing Company, Power Building, Montreal.

HEATING AS A PHASE OF ORE TREATMENT

By F. L. Grammer.

The ingredients lost by heating ores are chiefly moisture, carbonic acid gas, combined water and hydrocarbons, oxygen, carbon, sulphur, arsenic, chlorine and volatile substances, such as lead, zinc, mercury, which may also be driven off; but it is generally with the first four substances mentioned that we have to deal.

Usually concentrators are concerned with change of size, but not appearance nor properties, while heating changes appearance and properties, and the enhanced percentage of desired remaining substance is a virtue of heating treatment that is often overlooked.

The age of heating processes is such that the etymology is vague and confusing. Certainly the baptisms of the processes are well performed. The names usually are derived from product produced.

Clay, in its original state characterized by its plasticity, becomes by the loss of continued water rigid and hard. Limestone by the expulsion of CO_2 is converted from a durable stone to lime, a substance which disintegrates in the atmosphere. Loose coal, smoky and soft, becomes hard and smokeless in coke. Soft clear gypsum becomes white plaster. White wood becomes porous black charcoal. The word "burn" covers in popular parlance all these operations, and yet the oxidizing, if there is any, is incidental in charring and coking and possibly in brick making, and does not exist in calcining. There is a burning to get the heat, but it is a burning of coal or gas as an auxiliary.

We "burn" lime to drive off CO_2. We "burn" brick to drive off combined water. We "burn" charcoal by expelling gases from wood. We "burn" coke by expelling gases from coal. We "burn" skin by blistering it. We "burn" castings by oxidizing and reducing carbon. We "burn" the joints of lead in an acid chamber when we melt them by a flame. We most correctly burn fuel, solid and liquid, and term it combustion. In literature "burn" is a synonym for order and warmth. I have known practical people to even confuse burn and melt.

Now these processes are all associated with loss in weight. Some are distillations and some not. These operations are better designated as calcining, charring, coking, etc.

Calcining, changing carbonates into oxides by heat is a term commonly applied to the treatment of limestone, magnesite and some ores. Calcining is also applied to brick production from clay, but "burn" is in practice a more general word. Roasting also is more generally used, and neither of these last words conveys the idea of expulsion by heat.

Charring is like calcining, save that heat is often derived by partial combustion of material treated, and the volatile constituents expelled are reclaimed as distillates.

Coking is like charring, except that in coking there is a plastic or fused period. Charring is wait at wood and coking, of coal.

Where one deals with processes older than chemistry or writing, the glossary is apt to reflect, carry ignorance.

The term reduction covers heating with oxygen removal. Calcining might be made to cover heating without oxidation or reduction, attended by loss in weight of chemically combined material. Much uncertia will be encountered in the pottery trade, however. For brick, baking is a preferable expression to burning.

Generally roasting cannot be regarded as a concentrating process, if the term roasting is restricted to oxidizing by auxiliary fuel. In pyrites the iron is raised in percentage in the residue as the sulphur burns for production of sulphuric acid. The Andean coal, which is burnt in order to ship the ash as a vanadium ore is an unusual case of concentration by oxidizing. The ash is about 20 per cent. of the coal.

Reduction is seldom carried on without later melting; but sintering devices are partial reduction and partial melting devices, and sintering is followed, as are most deoxidizing operations, by loss in weight.

Drying is simply expulsion of water held in interstices and pores.

Just as mechanical concentration, which is carried on to save fuel, remove impurities and raise the percentage of mineral sought, is usually effected at the mine in order to save freight, so we often coke at mine, char in the forest, calcine at the quarry, unless the market for by-product or superfluous heat at the smelter promises larger profits.

This ground is old. Recently two new applications have been suggested, and one of these is being carried out.

Drying iron ores before shipping.—Mr. Ruggles, in the Iron Trade Review about a year ago, showed that under existing price schedules for Lake iron ores that large returns on investment can be obtained by drying fine wet iron ores at the mine.

These driers of Ruggles and Brittner have very high efficiency in heat utilization, over 80 per cent. being attained.

While their most attractive field is in treating materials of organic origin containing 50 to 95 per cent. volatile constituents, yet with slimes—wet concentrates where moisture may run up to 20 per cent., and with very fine ores about the same—drying offers savings in freight and a better market price. Lump ores contain but 4 per cent. moisture and less; when ores are dried they often reabsorb 6 per cent. moisture from air and rain in transit in open cars and in stockpiles.

The writer thinks the inference to be drawn from the investigation is as much that the schedules should be altered, as that the ores should be previously dried completely or down to 6 per cent. Certainly drying ores in winter means easier unloading and better circulation of cars and considerable saving in demurrage. Manganese ores are bought on dry analyses, water weight being deducted. This seems sounder than the schedule obtaining for Lake ores; but is also capable of being bettered in another way.

Suppose raw wet ore contains 20 per cent. moisture and 40 per cent. iron; that a 40 per cent. ore commands 5 cents per unit and 50 per cent. ore commands 8 cents per unit; that coal cost and labor cost of drying is 37 cents, and that all forwarding is $1.80 per ton, we have then a delivered price of 40 cents in favor of drying, as indicated below:

$40 = $2.40

$50 = $4.00 less 20% loss = $3.20

$3.20 − $2.40 = 80

80 − 37 = 43

Considering the tonnage a drier handles, this gives an enormous return on the money invested and suggests also that iron ores should be bought on dry analyses.

Most readers will regard this profit as fictitious, and think that the real saving is 20 per cent. of $1.80, or 36 cents, which is hardly equal to the cost of drying—if we overlooked the advantages in winter for forwarding. If the freight were $6, as on manganese ores or some slimes, the profits would be more apparent—even with more expensive fuel at isolated distant points, spots such as Russia, India, Chile and Brazil. In steamer forwarding the ore is less exposed to air and so can absorb less water, even when completely dried.

Suppose we had a fine ore with 15 per cent. moisture, that freight is $6, and cost of drying 60 cents, because coal is costly. Then we have 30 cents per ton saving. In a lesser degree drying also saves money on insurance, lighterage, unloading, railroad freight and possibly in royalties, export and import tax, demurrage, dock charges, etc. The topic is pertinent today with ocean freight at prohibitive figures and vessels difficult to find everywhere.

Heat treatment of manganese ores.—There are chemical combinations of loose bind which depart at low temperatures and which can be expelled at or near the point of origin with advantages both in freight and better price obtained.

Let us take a manganese ore with 45 per cent. manganese dry. If we expel by partial reduction 10 per cent. of its weight in oxygen, our 45 per cent. ore becomes a 50 per cent. ore. If 45 per cent. manganese brings 22 cents per unit and 50 per cent. 25 cents per unit, we have $1.35 increase in profit as indicated.

25x50=$12.50
22x45= 9.90

$2.60

Weight has been reduced 10%——$1.25
Cost of expulsion— .40

$1.65

2.60 — 1.65 = .95 cents net profit.

There is a freight saving of $6.00x10% equals 60 cents and a saving in water freight of 30 cents.

The buyer may object to receiving fine ore—but at the large shipping ports there must be much fine ore which could be handled economically, particularly if petroleum or gas is cheap.

It is a new field relatively and only sketched here. Personally I think that for electric smelting fine ores, even manganese fines, can be successfully agglomerated.

These remarks show that heat agglomeration, whether nodulizing or sintering, is accompanied by a reducing in weight, and so means usually concentration and saving in freight, duties, etc. Pressure agglomerators are not concentrators—they are diluters if a bind is added. Hence they are usually better used at the final destination.

If oxygen expulsion is done by heat and not by reducing gas, higher temperatures and more fuel will be needed. Usually only the purest pyrolusite was used as a source of oxygen; but if our economies in freight and advantages from better price will pay for oxygen expulsion by heat (not reduction), then the expelled product becomes a source of profit. I am told oxygen is now being derived frequently from fractional distillation of liquid air; but if manganese oxides—by partial expulsion—can give 3 profits one may expect an impetus to this method of obtaining oxygen.

The drier people claim it pays to dry if freight is over 3½ cents per hundred, coal below $4 per ton, and moisture over 12 per cent.

Some might expect that the drying would save money in fuel by performing work ultimately performed by the smelter. If the ore were coarse this might be so, and if there were a shortage of gas the preliminary partial reduction of ore might help; but there is a surplus of gas rich in CO in the furnace. I think little advantage can be expected from fuel saving. It might be added that the gas being lower in oxygen and CO_2, will be improved. This is no small matter where a market for gas exists.

WATER POWERS OF CANADA

The water power branch of the Department of the Interior is to be congratulated upon its enterprise in endeavoring to bring before the public a fuller knowledge of the vast water power possibilities of Canada. To stimulate interest in this subject, the branch has arranged an excellent exhibit of models and photographs of water power plants in the Canadian Pavilion at the Panama-Pacific Exposition, and it has now supplemented this work by a series of excellent monographs upon Canadian water powers for distribution at the Congress of the International Engineering Societies which met in San Francisco.

While the information contained in this booklet is intended to be brought before foreign investors and those interested in the industries that require the use of power, the subject matter forms most interesting reading to the Canadian public.

It is surprising and decidedly pleasing to be informed that in the province of Ontario, the total amount of hydraulic power capable of development is nearly 5,000,000 horse power, and that 702,000 horse power has already been developed.

In the report on Ontario powers Mr. H. G. Acres has analyzed the power possibilities of the province by grouping into districts those developments that fall together from a natural and topographical standpoint. Thus he has described the present and possible developments of the Ottawa river and its tributaries, the rivers tributary to the Great Lakes, the Winnipeg river and its tributaries, the rivers flowing into James Bay, and the international rivers of Ontario, and has outlined the hydrological and geological characteristics of each group. As a result of this, the reader is given a clear and impressive idea of the magnificent potentialities of our rivers, together with an idea of the commercial feasibility of their early development.

In the monograph by Mr. G. R. C. Conway, which is a very comprehensive record of practically all the existing water power plants at present developed in British Columbia, it will be a surprise to many to read how much has already been accomplished in the development of the water powers of the coast province. The author who, as chief engineer and consulting engineer, has been identified with the construction of several of the largest plants in British Columbia, has fortunately in the preparation of his book, received the hearty co-operation of the engineers and managers of the various power companies, and has therefore been able to give a very complete description of the

many interesting works that have been carried out during the last seventeen years, and has compiled a volume that will be a permanent record of what has been accomplished up to the present time.

Mr. Conway has prepared a very interesting table showing that already the installed capacity of turbines and impulse wheels amounts to 330,000 horse power, of which amount over one-half has been installed during the past five years—a period that has seen such great expansion in British Columbia.

In the monograph on Quebec Water Powers, Mr. F. H. Kaelin draws attention to the prominent part the extensive water powers of Quebec Province will undoubtedly play in the industrial development of the country. The Province of Quebec is extremely rich in water powers. According to Government investigation the available water powers of Canada amount to 17,000,000 horse power, of which 5,600,000 horse power is in Quebec Province. It is the author's opinion that these figures are very conservative, and could be materially increased if the flow of some of the rivers were regulated by means of suitable storage reservoirs.

In the Maritime Provinces there are about twenty strictly hydro-electric developments, with installed capacities from 100 to 200 horse power, except in one instance, where 3,800 horse power is installed. The total water power developed is believed to be about 34,500 horse power, the greater part of which is used in connection with pulp mills and saw mills. The greatest water power asset of this part of the Dominion consists in the abundance of relatively small sites in almost every part of the country, which can easily be made available for all local purposes.

One of the series of five monographs relates to Manitoba, Saskatchewan and Alberta, the Prairie Provinces, and is under the authorship of Percival H. Mitchell, E.E., of Toronto, a well known engineer and one of the consulting engineers to the water power branch.

In the consideration of the water powers of Manitoba, Saskatchewan and Alberta, two river systems stand out pre-eminently, that of the Winnipeg river in Manitoba, and the Bow in Alberta. The rapidly increasing utilization of these rivers for power purposes, the power plants at present contemplated for construction, and the value of the potential water powers not yet awarded, has required the immediate attention of the Dominion Government as to the possibilities in each case, and these demands have resulted in exhaustive investigations.

MINERS' WEEK AT THE P. P. I. E.

By F. H. Mason.

Miners' Week, September 20th to 25th, at the Panama-Pacific International Exposition, has come and gone. Whether, as a whole, it can be voted a success is doubtful, but, at any rate, for knitting up old friendships and making new it must have been gratifying to many. An engineering convention, with mining and metallurgical branches, was held during the entire week at the new, beautiful city auditorium, under the auspices of the P.P.I.E., and many interesting papers were presented. Unfortunately, in the majority of instances, the authors were absent, and only abstracts of their papers were read, and with few exceptions the discussions were of a half-hearted nature. There is the consolation, however, that many of the papers were of sterling worth, are likely to find their way into the technical papers, and can be digested at leisure.

A field meet, under the auspices of The California Metal Producers Association, The National Safety Council and The United States Bureau of Mines, was held on the lawn of the North Gardens of the Exposition grounds and competitive trials in mine-rescue work and first aid to the injured were conducted. This was undoubtedly the most interesting feature of the week; teams from eighteen different states competing. There seemed to be a plethora of prizes, which varied from a year's subscription to a mining paper to silver cups and gold medals, for these events, and, as far as the writer, who attended the presentation of awards, was able to discern, every team received some reward and everyone went home happy. The Homestake team, which scored a first in first-aid work, and the Utah Fuel team, which was first in mine-rescue work, carried off the pick of the prizes, but the contests were so keenly fought that a number of ties resulted, and, as time did not allow of the recontesting of these events, the drawing of straws had to be resorted to. The utmost praise must be given to many of the teams, who have picked up the work splendidly in a short time, and, should necessity occur, may be expected to give a good account of themselves in actual accidents.

For the tests in mine-rescue work, a "mine," which consisted of a skeleton "level," made of 2 by 4 studding, an enclosed inclined "raise," another short "level," a "winze," at the bottom of which was another skeleton "level" was provided. The "raise," short "level" and "winze" were filled with formaldehyde and sulphur dioxide. At the end of the skeleton "level," basking in the glorious Californian sunshine, was a miner who was supposed to have been overcome by asphyxiating gases. The rescue crew, equipped with oxygen helmets and apparatus, started into the "level," the captain, carrying a canary in a cage, carefully tapped the studding—I mean roof— as he went. When they reached the "raise" the captain mercifully deposited the canary on the lawn, and the team boldly plunged into the asphyxiating gases, up the "raise," along the "level," down the "winze," once more into the pure air, and along the final "level" to the "asphyxiated miner." They placed an oxygen apparatus over his mouth, and carried him back the way they had come. When the patient was brought to the "surface" he was "resuscitated" in the usual way. There were a few other obstructions, not mentioned, in the "mine," presumably caused by an explosion.

For an exhibition, made before a crowd of people, the arrangement was probably as good as could be wished, but to the practical man the trials had their comic sides, at times. Particularly was this the case when the rescue team were fixing the oxygen apparatus on the patient and several members of the team [illegible] outside the "mine."

Another instructive feature was the coal-dust explosion. For this a wooden stave pipe, 6 ft. in diameter by 120 ft. long, held together by steel rings and calculated to stand a pressure of 25 lb. to the square inch, was used. From 75 to 100 lb. of coal was distributed through this and one and a quarter lb. of black blasting powder was fired from a cannon into it. The explosion set in motion and expanded the coal dust, causing a tongue of flame fully fifty feet long to issue from the mouth of the tube. As before, gas was given and the men drove up in the mine-rescue auto trucks, donned oxygen helmets, and explored the "mine."

INDUSTRIAL RESOURCES OF THE NORTHWEST

An interesting five-page report of the fifty-first meeting of the American Chemical Society, held in Seattle, Washington, from Tuesday, August 31st, to Friday, September 3rd, was published in Metallurgical and Chemical Engineering Journal, New York, and that publication described the meeting as having "proved unusually successful and enjoyable." Further, "it was a somewhat 'old-fashioned' meeting in the best sense of the word, with a preponderance of general meetings over sectional sessions, with the attendance always held well together, and a true, congenial happy spirit prevailing all around." The attendance during the general meetings was nearly 200. Chief prominence was given in the report to an address by Dr. H. K. Benson, of the University of Washington, on "The Industrial Resources and Opportunities of the Pacific Northwest." The following are excerpts from the address:

"The Pacific Northwest constitutes an industrial unit which comprises the States of Oregon, Idaho and Washington, the Province of British Columbia in Canada, and the Territory of Alaska. Although composed of different political parts, whereby the natural course of industry may be hindered or benefited, yet the ultimate outlet for commodities is largely confined to the cities touching the waters of the Pacific Ocean. Material development of any portion of this area is felt throughout all of it. While it would be of great interest to discuss the potentialities of the Pacific Northwest as a whole, the lack of published data would make it necessary to collect and compile at first hand much of this information. Time does not permit of such an extended investigation of this at present, and it is proposed, therefore, to present in some detail the resources of the State of Washington as a typical example of what may be found in varying degrees throughout the entire Pacific Northwest.

"The total area of the Pacific Northwest includes nearly a million and a quarter square miles, distributed as under:

	Square Miles.
Oregon	96,607
Washington	69,180
Idaho	83,888
British Columbia	395,500
Alaska	586,400
Total	1,231,575

". . . . While a large portion of Alaska is mountainous, less than one per cent. of its area consists of permanent snowfields, and its agricultural valleys contain as much tillable land as is cultivated in the States of New York, Pennsylvania and Ohio."

After dealing generally with the lumber, fisheries and fertilizer industries, Dr. Benson proceeded:

Coal and Oil.

"In the past the industrial welfare of a community was dependent upon its nearness to a coal deposit, but in the Northwest coal has competitors in the great quantities of oil from California and the electrical power of the mountain streams of the Northwest. The annual production of coal in the State of Washington is nearly 4,000,000 tons, while that of British Columbia is 2,500,000 tons. The total supply of coal in the Pacific Coast States is estimated by Campbell and Parker at 22,000,000,000 tons, of which 20,000,000,000 tons is in the State of Washington. The coalfields of Alaska cover 12,667 square miles. The estimate of the United States Geological Survey places minimum coal resources of Alaska at 150,000,000,000 tons, which is far in excess of the original coal supply of Pennsylvania. Unlike the latter, however, much of this coal consists of lignites, the utilization of which calls for new methods and processes. Even in the State of Washington and adjacent to the coalfields themselves fuel oil transported from California displaces annually a quantity of coal greater than that consumed.

Water Power.

"The water power resources of the Pacific Northwest constitute an important factor in power production. The estimated developed water power of the Pacific Northwest, exclusive of Alaska, exceeds 650,000 horse power. The estimated undeveloped power of the Columbia River basin is approximately 20,000,000 horse power, or one-third of all the undeveloped water power in the United States, and equivalent to all the water power found in the twenty-six States east of the Mississippi River. Within economical transmission of our larger cities on tidewater may be generated at least one-fifth of the available water power of the United States, exclusive of Alaska. The water power resources of the latter are said to exceed those of the Pacific Coast States.

Mineral Industry.

"Much has been written of the mineral industry of Alaska and the Northwest, and it would become tedious to particularize concerning its extent and importance. The annual production of gold and silver in normal times is approximately $35,000,000. For the year 1913 the production of copper was valued at $11,300,000, of lead at $15,600,000, and of zinc at $2,500,000. The development of deposits of minor minerals has not been extensive, due to their remoteness from suitable smelting facilities. On the Seward peninsula is a tin-bearing district of 450 square miles. Alaska has produced since 1902 more than 560 tons of tin. Antimony ores are found in Alaska and Washington, molybdenum in British Columbia and Washington, tungsten in Alaska and Washington, while platinum is found in the sluice boxes of many of the placer camps of Alaska. Arsenic ores abound in the Monte Cristo district of Washington, and are smelted with the recovery of white arsenic at the Everett smeltery.

"Graphite, gypsum and barytes exist in commercial quantities in Alaska. In Washington and adjoining portions of British Columbia occur the only large deposits of limestone situated on deep water along the entire Pacific Coast of the United States and Canada. Extensive deposits occur in the northern tier of counties from Puget Sound to the Idaho boundary. These deposits constitute the sources for six Portland cement, one hydrated lime, and numerous lime-kiln plants within the State of Washington.

"Clay deposits suitable for use in common brick manufacture are widely distributed throughout the Pacific Northwest, as are also those adapted to the manufacture of drain tile. In numerous places are also found deposits of clays which can be used for the manufacture of paving brick, sewer tile, terra cotta and firebrick. Both Washington and British Columbia are now producers of refractory brick of a high grade. Washington now ranks fifteenth in the production of clay products in the United States, forty-five firms being engaged in the industry and producing annually wares valued at more than $2,000,000.

"Deposits of diatomaceous earth of superior quality have been investigated in five places within the State of Washington. Apparently enormous quantities of this

material exist in this State. Deposits of magnesium carbonate and other magnesium salts have been reported, but have not been utilized. Among other raw materials available in the Pacific Northwest are iron ores suitable for mineral paints and perhaps for pig iron; talc for use as a filter in paper manufacture; silica for glass, and sand, lime, brick and large deposits of stone for structural purposes. Among the latter especial mention should be made of the Alaskan marble and of the granites and sandstones of Washington. At least three extensive deposits of tufa rocks occur in Oregon and Washington."

BETHLEHEM STEEL

How Bethlehem Steel, which a dozen years ago was a creditless corporation hardly able to pay its 3,000 employees, rose to its present position under Charles M. Schwab, is being told in series of copyrighted articles in the New York Herald. The corporation to-day employs 40,000 men, has $300,000,000 of contracts for material for domestic and foreign consumption, and is spending more than $40,000,000 in extensions and improvements.

Mr. Schwab first bought Bethlehem Steel Co. in 1902, when he was president of the Steel Corporation. "I cut loose from the Steel Corporation," Mr. Schwab is quoted, "because it was managed in New York and not in Pittsburgh. The directors did not give me the freedom of action I desired. I determined to reorganize Bethlehem Steel and have it managed entirely on the ground."

After buying Bethlehem Steel for $15,000,000, J. P. Morgan persuaded Mr. Schwab not to retire from the presidency of the Steel Corporation at that time. Mr. Morgan took Bethlehem Steel off his hands and held it for two years, at the end of which time Mr. Schwab retired from the Steel Corporation and organized United States Shipbuilding Co., to which Bethlehem Steel was sold. When the shipbuilding company failed, Mr. Schwab was left with Bethlehem Steel on his hands.

The number of men employed by subsidiaries of Bethlehem Corporation are given as follows: Fore River Shipbuilding Corporation, Quincy, Mass., 5,000 men; Union Iron Works Co., San Francisco, 3,000 men; Harlan & Hollingsworth Corporation, Wilmington, Del., 2,000 men; Bethlehem Chile Iron Mines Co., 2,000 men; Juragua Iron Co., Cuba, 1,000 men. There are numerous other subsidiaries employing less than 1,000 men each.

Concerning the fourteen "boys" (directors of Bethlehem Steel and heads of departments) Mr. Schwab said: "I determined to train the prospective heads of Bethlehem Steel Co. as Mr. Carnegie had trained his boys. I selected for the dozen heads I required boys who already were at Bethlehem. Most of them were born there. I felt sure that under different direction they would all make a signal success. Not one of those boys has slipped a cog. They are the life and soul of Bethlehem Steel Co."

Among the "boys" mentioned by Mr. Schwab are "Gene" Grace, who became president of Bethlehem Steel Co. in 1912 when he was 35 years old, and who is described by Mr. Schwab as "the greatest steel man in the country." He went to work for Bethlehem as a laborer, and was "discovered" when he was running a crane at $15 a week. Another is Archibald Johnston, vice-president of Bethlehem Steel Co. None of the Bethlehem Steel officials, it is stated, gets a salary of more than $100 a week, though their incomes range from $100,000 to $1,000,000 a year, due to premiums on production or economical management of their departments.

"There is absolutely nothing in talk that I am going to retire," Mr. Schwab is quoted as saying. "I shall never stop work; never give up Bethlehem so long as I live. The mills and the men who make them are my life, which is dedicated to their progress and improvement. I propose to make Bethlehem bigger and better, and the money I make will go right back into the plant. I want to make it the highest possible success—the steel standard of the world."

Project which paved way for Bethlehem to crown herself with the diadem of the largest steel plant in the world was conceived in 1857, when residents of the vicinity obtained a charter for the Saucona Iron Co. to build an iron works on banks of the Lehigh River at South Bethlehem, Pa.

First steel to be made by the bessemer process was produced at Bethlehem, October 4th, 1873, and the first bessemer steel rail was rolled two weeks later. In 1886 construction of an armor plate works was begun and in 1887 contracts were taken from United States Government for armor plate and gun forgings.

Under Mr. Schwab's management the Bethlehem Steel Co. has been a leader in the design and development of ordnance equipment, which is used at this moment by every nation on earth. During the decade of his reign the South Bethlehem works have been quadrupled in size. The South Bethlehem plant now covers an area of 1,350 acres and more land continually is being added or acquired.

One of the greatest factors in the overwhelming success of Bethlehem Steel is not only that it owns and operates ore mines, but that its supply in far off Chile and Cuba is so much purer than the domestic deposits which are at its doors, that the consequent economic benefit is more than enough to offset seeming advantage of proximity.

Tests of shrapnel are most rigid at Bethlehem. One per cent. of all shells it makes are exploded and fragments are recovered as far as possible, carefully counted, weighed and placed together. Number of pieces of one armor-piercing shell recently recovered was more than 1,000.

MICHIGAN COPPER SHIPMENTS

Marine records of copper shipments by water disclose the interesting fact that the biggest individual shipment of red metal by boat was made on November 22nd of 1914, when the North Sea of the Mutual Line cleared from the Michigan copper country with 5,475 tons of lake copper, a cargo valued at $2,000,000. This shipment was approximately twice as large as any previous boatload of copper from this district, and is a record that will probably stand for all time as it was a risk the insurance companies will not care to accept again.

To date the shipment of copper from this district by water is approximately 25,000 tons over the corresponding time in 1914, and the total increase will be in the neighborhood of 50,000 tons for the entire season. That this will be accomplished is substantiated by the statement that copper has been moving more rapidly in the last few weeks than for the previous month.

Lake copper shipped to Sept. 1st to the end of August, 1915, totaled 40,622 tons, while the total water shipment for 1914 was 54,731 tons from copper country ports.

GOLD MINING IN YUKON

The "Nelson Mining News," under date of September 15th, printed the following from a Dawson correspondent:

The Yukon territory has contributed to the outside world approximately $185,000,000 in virgin gold. This sum has come chiefly from the placers within fifty miles of Dawson. Other rich creeks within one hundred miles of Dawson have furnished the bulk of the remainder, though a portion has come from more distant locations.

Since 1910 the shipments from Dawson have approximated $5,000,000 annually. Last year they went slightly under $5,000,000 and a little below the total of the year previous, the slight shrinkage being accounted for to considerable extent by the breaking down of one of the largest dredges just as it got into the best of pay. The same dredge has been out of commission all this season, undergoing repairs, and it is not certain when it will resume work, so that it is not aiding in this year's totals.

Another dredge, which worked most of last year on Bonanza, is idle this year. But, notwithstanding the idleness of the two dredges, the other dredges are making a splendid showing. The Yukon gold dredges have been in some of the richest ground this year that they ever worked, and as a consequence the total yield for this season of the Klondike camp is ahead to-day of what it was at this date last year.

The Yukon Gold Company worked one virgin claim, No. 21, on Eldorado, this season, from which an enormous sum was taken. The claim was bought in the early days of the camp by John J. Healy, the veteran frontiersman, for the N. A. T. & T. company, and never was worked.

Representatives of the two companies say nothing of the total cleanup, but rumor has it that the dredge got fully half a million dollars in gold. Some Eldorado claims yielded much better than that by old methods. T. S. Lippy, of Seattle, is said to have cleaned up more than a million and a half from No. 16 Eldorado, and No. 17, which was owned by Jim Hall, was a marvelous producer.

Both of those claims, like nearly all the best Eldorado properties, were worked by steam thawing and hoisting methods. The old system required five or six years to work out a claim, whereas the dredges now work out several of the claims in a single season, and take up several feet of bedrock and get much gold which the miners, by the old methods, could not get.

Although the yield now is slightly lower than a year or two ago, and Bonanza and Eldorado are worked by the new methods to a large extent, other creeks which have been under preparation for the new methods are expected to begin yielding in another season. The Treadgold properties on Dominion and Quartz creeks, totaling many miles, have been in preparation for several seasons, and the first excavator or machine for working there on a large scale has just arrived and is now being hauled to the creek and is to be set up this fall.

Mr. Treadgold is expected to arrive here this fall to see it work. The machine was worked in England as a test before being sent here. Similar excavators are used for other classes of mining on an extensive scale in other parts of the world.

The gold produced in the Klondike camp now by dredges comes chiefly from the Klondike River between Bear and Bonanza creeks, and from Bonanza, Eldorado, Hunker and Gold Run creeks. The largest hydraulics are along Banzan benches and Eldorado benches. Milvain is working a dredge on Miller creek. Individual productions also come from Sulphur, which now leads in activity on old time methods; Quartz, Gold Bottom, and a few claims along other old time creeks near the city and elsewhere in the territory.

It has been estimated by some that the placers in the old Klondike district, that is within fifty miles of Dawson, still contain $130,000,000 to $150,000,000. The Treadgold properties on Indian River, Dominion creek, Quartz creek, Sulphur and tributaries alone aggregating 75 miles or more, have been estimated in the company's prospectus to contain fully 300,000,000 cubic yards, carrying 30 cents to the yard or $90,000,000. It was stated some time ago that eight miles of gravel between Bear and Bonanza creeks on the Klondike remaining to be worked and carrying gravels worth 22 cents a yard, contain fully $20,000,000.

The Yukon Gold Company's properties remaining in the camp are believed to contain fully that much if not more. They include besides properties on Hunker, Eldorado and Bonanza not yet worked. A large portion of Gold Run, Upper Gold Run, comprising 70 claims, also is practically unworked. The Yukon Gold controls Gold Run from 45 to the mouth. Many other creeks in the territory also are being worked by individuals and may yet yield millions.

Creeks which have been looked on as possible dredge propositions, but which are yet in the hands of individuals, include Gold Bottom, All Gold, Eureka, Clear, Barlow, Scroggie, Mariposa, Henderson, Barker, Thistle, Britannia, Canadian, Nansen, Livingstone, Big Salmon, some of the Kluane creeks, Highet and several others of the Mayo district, and a long mileage on McQuesten, many miles on Fortymile and tributaries, while below the Yukon boundary are numerous creeks in the gold belt in the Circle district, including Independence, Mammoth, Mastadon, Woodchopper and Coal creek; the several creeks about Eagle and others on which individuals have taken much gold.

If the Treadgold excavator works as estimated, it will bring many of the lower grade creeks into the producing zone which years ago never were dreamed of as being workable at a profit, but which are indicated to contain such pay that were they in a thawed zone would produce multiplied millions even by the old dredge methods. Some predict that ground sluicing and scraping or excavator methods, if not dredging, will yet win their golden treasure, and good profits to the operators.

NOVA SCOTIA STEEL.

New Glasgow, N.S., Sept. 29.—A meeting of the Nova Scotia Steel and Coal directors was held at the head office of the company, New Glasgow, to-day. The meeting was attended by Governor J. D. McGregor, Halifax; W. D. Ross, vice-president, Toronto; J. Walter Allison and George S. Campbell, Halifax; W. H. Chase, Wolfville; Frank Stanfield, Truro; R. E. Chambers, James C. McGregor and President Thomas Cullen, New Glasgow.

The general manager submitted statements relative to the business of the company for the past month, which was considered most satisfactory.

The output of shells for September was the largest yet shown, being forty per cent. over that of August. The orders on hand were reported as being equal to six months' full capacity of the plant at its present high rate of production. It is reported that the meeting also discussed some further large orders. A further proposal as to additional foreign cars was also under discussion.

The payroll for the past two weeks was $75,000 and the wages paid by the company in its steel plant at New Glasgow alone is now at the rate of $150,000 per month, by far the greatest in the history of the company.

WATER POWERS OF LABRADOR

By J. W. McGrath.

The peninsula of Labrador, although only explorations and prospecting of the most general nature have yet been conducted over its area, has given some notable indications of the existence of mineral ores. Last year another valuable deposit of copper was discovered. The deposit is owned by W. H. Taylor & Co., who I understand, have determined to make an attempt this season in way of development.

All the other high grade ores that have from time to time been discovered on the coast have so far, without exception, remained unworked. The comparative isolation of the district has served to dampen greatly the enthusiasm of prospective investors.

What would enhance the value of these properties if worked are the facilities in the nature of water powers that are present and which can be acquired at ridiculously low figures. This is so because of the number of powers that exist there, and the enormous sizes of many of these powers. Labrador has been termed the land of fish, the land of ice, and many other half truths. But as the region becomes to be more and more known and explored it will be termed, and correctly so, the land of the cataracts.

Labrador is a Region of Cataracts.—Take Labrador from the whole of the area of Canada and possibly 15,000,000 horse power could be developed; include Labrador and the potential water power jumps to 25,000,000.

The largest of the number of large falls there is the Grand Falls. This has a head of 302 feet and, if harnessed, would produce 120,000 horse power. If the twelve miles of rapids above and below the main falls are included it has a head of 760 feet and is capable of producing 300,000 horse power, and this is the most conservative estimate that has yet been made. Dr. A. P. Low, of the Geological Survey, estimated that the main falls could be made to yield 1,500,000 horse power, which, taken conjointly with the smaller rapids above and below, would give an estimated aggregate total of 3,600,000. These figures as compiled by Dr. Low were only given as approximations and are without doubt much too high.

In his description of the Grand Falls, Dr. Low has written "Such a fall would not be extraordinary for a small stream in a mountainous country, but is phenomenal in a great river like the Hamilton. The basin into which it precipitates itself at this point is nearly circular and about two hundred yards in diameter. It is surrounded on all sides by perpendicular rocky walls 500 feet high, except at the narrow cut at the lead of the falls and where the river issues from the basin. The noise of the fall has a stunning effect and, although deadened because of its enclosed position, can be heard for more than ten miles away."

Mr. Henry G. Bryant, who has written a pamphlet on this falls, says, in part: "The height of the fall may be considered something more than three hundred feet, the vertical height of the chute thirty-two feet, and from the head of the chute to the surface of the water in the chasm about three hundred and forty-eight feet. The Grand Falls of Labrador . . . are nearly twice as high as Niagara and are only inferior to that marvellous cataract in breadth and volume of water." This great falls is situated on the Hamilton River which flows into Hamilton Inlet. To date it has been left to boom over the rapids unharnessed.

The falls next in importance, when both convenience and size are taken into consideration, is the Muskrat Falls. This fall has a head of something over seventy feet. In horse power it is capable of supplying 90,000. It is most conveniently situated, being about six miles from the tidal waters. On this same river in succession are a series of large rapids, the largest of which are the Minipi rapids, the Horse Shoe rapids and the Gull rapids, all of which contain large bodies of water.

The water powers are not confined to any particular area; but are most evenly distributed over the whole of the peninsula. In the district farther north from that which contains both the Grand and Muskrat Falls, are several gigantic bodies of water. At Nakvak the Great Silver Falls leaps 400 feet into the sea.

In the southernmost portion of Labrador, the giant falls have changed into numbers of rapids ideally situated for any hydraulic purposes, all being practically on tidal waters. There are here a multiplicity of smaller rapids capable of producing from five hundred to five thousand horse power. Rapids that are much larger than these are the Eagle rapids on the Eagle River, and the Gilbert rapids on the Gilbert River.

Flowing into the Straits of Belle Isle and the Gulf of St. Lawrence are the rivers St. Augustine, Esquimaux and Roman. At different points up these rivers are located splendid water falls, which with a minimum of expense could be made to produce large water power.

In that portion of Labrador known as Newfoundland-Labrador, perhaps the best water falls are contained, and these are especially easy to acquire at very low cost. One of these water powers was granted last spring by the Newfoundland Government to the Newfoundland Products Corporation on condition that this corporation keep an agreement made to the Newfoundland Government to establish an industry for the production of ammonium phosphate in Newfoundland. The agreement ran in part: "The Government will grant the company a water power on the Hamilton River from the head of Lake Winoeapan to the sea, or an equivalent water power on the Northwest River, Labrador," on the conditions stated above.

The company in return for this concession has undertaken to furnish up to 50,000 horse power to all persons or companies operating within one hundred miles of [illegible] power horses.

If development is to take place in mining in Labrador the water powers will be in demand. The coast is so remote that to deliver coal there even in the largest quantities would cost from $8 to $10 per ton; hence the value of these water falls to the district is readily discernible.

All mining operations therefore will be through the medium of hydraulic electrical power, which while being absolutely necessary, is cheaper than coal.

BOOK REVIEWS

Mining World Index of Current Literature Vol. VII. First Half Year 1915—by Geo. S. Sisley. Associate Editor Mining and Engineering World. Price $2.00 For sale by Book Department, Canadian Mining Journal.

The Mining World Index is one of the most useful publications for those who have occasion to consult the literature on mining, metallurgy and kindred subjects. Articles published in the most important current books, etc., in America, Europe, Africa and Australia are carefully indexed in a manner which makes [illegible]

HOLDINGS OF THE INTERNATIONAL NICKEL CO.

The listing application of the International Nickel Co. to list the securities of the company on the New York Stock Exchange stated that the company's ore deposits are located in the Sudbury nickel range, Ontario, being 36 miles long and 16 miles wide. About $500,000 spent in the last two years for diamond drilling and development has resulted in uncovering of paying ore estimated at 57,000,000 tons, sufficient, at present rate of consumption, for more than 50 years.

The ore consists of sulphides of copper, nickel and iron, with copper contents ranging up to 3 per cent. and nickel up to 4 per cent. The sulphides are largely massive and remarkably free from rock, so that only small expense is entailed for sorting and no concentration system is necessary. For each ton smelted a charge against earnings is made, based on estimated life of the mines, that their capital value may be amortized at extinction of the ore bodies.

The main ore supply is the Creighton mine, served by two 3-compartment shafts. Shaft No. 1 is down 300 ft. and No. 2, 700 ft. An underground crushing plant of the sixth level mines, crushes and sorts about 75,000 tons a month. The company is spending about $750,000 on a new shaft, shaft house and crushing plant. The new shaft has five compartments, and is amply sufficient to handle such increased tonnages as may be required for many years.

The Crean Hill mine supplies ore higher in copper ratio. Its shaft is down 500 ft., and its machinery hoists, crushes and sorts about 1,000 a day. No. 2 mine shaft is down about 1,100 ft. and handles about 400 tons a day. No. 3 mine has two shafts, each 300 ft. deep and fully equipped. It is unworked at present, but has a capacity of 40,000 tons a month.

The Vermilion mine, located about a mile from Cream Hill, is in process of development on account of possible occurrence of precious metals.

Canadian Copper Co., a subsidiary, has capital investment of $6,123,385 in buildings, machinery and equipment. The smelter and principal plants are at Copper Cliff, Ontario, and consist of seven large blast furnaces, five basic converters and large reverberatory plant with a capacity for treating 100,000 tons monthly. The company also owns 20 miles of main line and yard tracks directly connected with Canadian Pacific and Algoma Eastern Railway, the latter connecting with Canadian Northern.

The company's refineries, known as the Orford Works, are located at Bayonne, N.J. They consist of five large nickel furnaces, 31 calcining furnaces, five refining furnaces, two copper cupolas and five copper reverberatories, with necessary converting equipment.

The Huronia Co., Ltd., another subsidiary, owns water power rights on the Spanish River, and 3,865 acres. The water power has been fully developed and the hydro-electric plant at High Falls, Ont., develops 12,000 h.p. with which the mines and smelters at Copper Cliff are supplied. The plant, dams and other parts of the work cost $6,801,089.

The Nickel Corporation, Ltd., and the Societe Miniere Caledonienne, both subsidiaries, own 9,217 hectares of mineral land and are joint owners of 3,848 additional hectares in the island of New Caledonia. Properties are not being operated except some small mines working on a royalty basis.

WASHINGTON ORE TO TRAIL, B.C.

During nine months of the current year, ended Sept. 30, mines situated in the State of Washington shipped 23,630 tons of ore to the Consolidated Mining and Smelting Co.'s smelting works at Trail, British Columbia. In addition, ore was shipped to the Granby Consolidated Co.'s smeltery at Grand Forks and the British Columbia Copper Co.'s works at Greenwood, but no particulars of the shipments to the two Boundary district smelteries mentioned have been received. Both Grand Forks and Greenwood have a decided advantage over Trail in the matter of distance from mines in Republic camp, though not in similar degree where those tributary to the Spokane Falls and Northern Railway, now part of the Great Northern system, are concerned. The railway distance from Republic, in which camp are situated most of the Washington mines that ship ore to British Columbia, to the smeltery at Grand Forks is only 37 miles; to the reduction works at Trail it is 134 miles. Against these short distances is that by Great Northern Railway from Republic via Spokane, Everett and Seattle to Tacoma, 558 miles. Under such long-haul conditions necessarily the ore goes to smelting works in connection with shipment to which freight charges are so much lower. To what extent the position will be affected when the smeltery at Northport, Washington, shall be again operating remains to be seen.

Of the total quantity of Washington ore received at Trail during the period above mentioned, 19,774 tons was from Republic Camp mines, 3,223 tons from Chewelah, 439 tons from near Bossburg, and the remaining 194 tons from a number of other properties also situated within easy reach of the Trail works. Particulars are as follows:

Mines.	Tons.	Tons.
Republic—		
Ben Hur	11,113	
Knob Hill	2,174	
Lone Pine	1,594	
Pearl	117	
Rathfon	335	
San Poil	1,394	
Surprise	2,390	
Trade Dollar	129	
Western Union	448	
Wiseman	80	
		19,774
Chewelah—		
United Copper		3,223
Bossburg—		
Bonanza		439
Sundry Small Shippers—		
D. Jones, and others, Nighthawk	82	
Old Dominion, Colville	41	
Inland, Bonanza	12	
Gold Cord, Keller	4	
P. LaPlant, Old Boundary	21	
Sunday, Meyers Falls	34	
		194
Total		23,630

During the corresponding period of 1914 the total receipts of Washington ores at Trail were 12,881 tons, of which 10,739 was from the Ben Hur and 1,130 from the Knob Hill Mine; the remaining 1,012 tons came from fifteen small shippers.

PERSONAL AND GENERAL

Mr. A. L. Bass, formerly superintendent of the B. C. Copper Co.'s Lone Star mine, situated across the International Boundary line and immediately south of Boundary district, has been appointed assistant superintendent at the company's Mother Lode mine, near Copper Co., at Butte, Montana, late in September, accompanied by Mr. R. C. Nowland, of San Francisco, California, field engineer for Mr. D. C. Jackling, to the Valdes group of islands, situated between Vancouver island and the Mainland of British Columbia, to examine the Valdes Copper Co.'s group of mineral claims on Quadra and Steep islands.

Mr. J. C. Buchanan, of Fort Worth, Texas, who is largely interested in the Yankee Girl mine, near Ymir, Nelson mining division of British Columbia, was at the mine recently on a visit of inspection.

Mr. Chas. F. Caldwell, of Kaslo, B.C., who for some years has been manager of the Utica silver-lead mine, in Ainsworth division, intends to give attention to the Pontiac mine, on Woodberry creek, leaving the active supervision of the Utica to Mr. Clyde White, son of Mr. Oscar V. White, of Sandon, Slocan.

Mr. Clarence Cunningham recently returned to Spokane, Washington, from another visit to the Slocan district, British Columbia. He and Mr. J. P. Keane are reported to have made temporary arrangements for the use of the concentrating plant near Roseberry, Slocan lake, where they will resume the concentration of custom silver-lead-zinc ores, which business was interrupted by the destruction of fire two months ago of the Ivanhoe mill at Sandon, that had been leased and operated by them.

Mr. R. D. Fetherstonhaugh has gone to Edmonton, Alberta, after having been on the Finlay river, which joins with the Parsnip river to form the Peace river. It is stated he has been investigating placer-gold prospects on the Finlay.

Mr. Edward H. Hamilton, manager for the Virginia Smelting Co., at West Norfolk, Virginia, U.S.A., was on the Pacific coast recently, having been one of a party of engineers who visited Victoria and Vancouver on their return journey east from a trip to the Panama-Pacific International Exposition. In Victoria he renewed an old-time friendship with Mr. W. Fleet Robertson, provincial mineralogist, to whom he was known in the early eighties of last century at McGill University, from which Mr. Robertson graduated in Applied Science in 1880 and Mr. Hamilton in 1884.

Mr. Gomer P. Jones, general superintendent for the Hedley Gold Mining Co., on the occasion of the fiftieth anniversary of his birthday last month, was the recipient of a silver loving cup suitably engraved, which was presented by the staff and other employees of the company in the service of which he has been for between fifteen and sixteen years.

Mr. Frederic Keffer, of Spokane, Washington, last month arranged to leave that city early in October on a trip to the Panama-Pacific International Exposition, going to San Francisco via Portland, Oregon.

Mr. Oscar Lachmund, general manager for the British Columbia Copper Co., left Greenwood on September 13 for San Francisco, to there attend the meeting of the American Institute of Mining Engineers, and visit the Panama-Pacific International Exposition.

Mr. R. G. McConnell, Dominion Deputy Minister of Mines, when in British Columbia several weeks ago, went to see the Molly molybdenite mine, distant 14 miles from Salmo, in Nelson mining division.

Mr. O. S. McKenzie, of San Francisco, after having been to see some of the ore showings in Franklin camp, Boundary district of British Columbia, went to Nelson, where it was announced he would investigate some mining properties in West Kootenay.

Mr. Dudley Michell, instructor in First Aid and Mine Rescue Work for the Provincial Department of Mines, returned to Victoria, B.C., on October 2, after having been to San Francisco, where he was one of the judges in the mine-rescue competition held at the Panama-Pacific International Exposition.

Mr. W. G. Norrie, who for a while after leaving Vancouver, B.C., was at the Consolidated Mining and Smelting Co.'s works at Trail, is now superintendent of the Silver Standard Mining Co.'s mine on Glen mountain, four miles east of Hazelton, in Omineca mining division, British Columbia.

Mr. J. M. Turnbull, who in 1897 graduated B.A. Sc. from McGill University, left Trail on September 23 for Vancouver, to enter upon his new duties of Professor of Mining Engineering, with Mrs. Turnbull, was presented with a silver coffee pot by members of the Trail Lawn Tennis Club.

Mr. W. E. Zwicky, of Kaslo, B.C., manager of the Cork-Province mines and concentrating plant, has been quoted by the Nelson Daily News as having stated that the raise from the long crosscut tunnel in the Payne mine, near Sandon, Slocan, would be 720 ft. in length. Later advice is that the raise has broken through to the old No. 8 level of the mine.

The directors of the Rambler-Cariboo Mines, Ltd., are reported to have declared a dividend of two cents a share, half to be payable on October 15 and the remainder on December 15. The total amount to be distributed is $35,000. The Kaslo "Kootenaian" states that it is twelve years since the company paid a dividend.

Mr. C. H. Poirier is in Duluth.

Mr. R. B. Lamb has transferred his office from Toronto to New York.

Mr. S. W. Cohen is in California.

Mr. M. W. Hotchkin, formerly mine superintendent of the Tough-Oakes mines, Kirkland Lake, is now manager of the Kenzie property, Boston Creek, Ont.

Mr. J. A. Baker is now on the staff of Moose Mountain, Ltd., at Sellwood, Ont.

A Ketchikan, Southeast Alaska, correspondent of Mining and Scientific Press, states that the Grandy Consolidated Co. is shipping nearly 12,000 tons of ore a month from the Mamie mine at Hadley, and more than 3,000 tons from the It mine, near Kasaan. Both mines are situated on Prince of Wales Island. The ore is shipped to the company's smeltery at Anyox, Observatory Inlet, B.C. The company's report for its last fiscal year has not yet been received, but in that for the year ended June 30th, 1914, its superintendent of mines reported of these two properties as follows: "Mamie—The ore here (135,200 tons) will average 2.25 per cent. copper, and from 25 to 30 cents gold and silver. The ore has a value also as a flux. Undoubtedly a small amount of development work will increase the tonnage in sight to a great extent." "It Dean—We have done so little work here that it is not possible to deal accurately with tonnage and value. We have at least 5,000 tons of ore that will run from $15 to $20 a ton. The properties are fully equipped and mining costs should not be excessive. We are very well pleased with the results so far obtained."

JOHN McMARTIN

The story of Canadian finance contains many romantic figures, but few whose career towards eminence in the financial world has been more interesting than that of John McMartin. Like a great many other Canadians who have gone to the top, the subject of this sketch was born with no silver spoon in his mouth. He had his own way to make in the world—and made it. To-day there are probably few more wealthy men in the country.

Descended from Scottish United Empire Loyalist ancestry John McMartin first saw the light of day in Glengarry, Ont., a district which has produced many remarkable Canadians. After receiving an education in the schools of his native place he set out at the early age of sixteen to carve his own niche in the commercial Hall of Fame. His first experience was in railroad construction work. At that time the Dominion Government had in hand the construction of a section of road near Port Arthur, which now forms part of the Canadian Pacific Railway system. With that thoroughness which is so strong a characteristic of the Scottish-Canadian generally, John McMartin made himself acquainted with every detail of the business of railroad construction. Lumbering experience in the State of Michigan followed the early railroad experience, and by this time, having attained a degree of confidence in his own ability, as well as a perfect knowledge of the business, he started operations on his own account.

As a builder of railroads John McMartin achieved considerable success, and while yet a young man was on the highway to fortune. If he had continued in his business there is little doubt that the time would have come when John McMartin would have acquired considerable wealth in the ordinary way of business. One of those curious freaks of fortune, however, which are said to occur at least once in the life of every man, brought Mr. McMartin into contact with the mining industry and with what was destined to be the greatest mining boom Canada had ever seen. Along in 1903 one Fred La Rose, a blacksmith by trade, employed on the construction of the T. & N. O. Railway, took to prospecting in his spare hours.

The outcome of the prospecting of La Rose was the discovery of the mine which later took the name of the La Rose Silver Mine. When the matter of registering claim, proving title and commencing mining operations came to be dealt with, difficulties were encountered in claims to the property made by other parties on the ground of prior discovery. The ensuing litigation, which was carried through the Canadian courts and to the Privy Council, is still remembered by many Canadians interested in financial and mining matters. All this litigation cost considerable money and the expenditure was made always with the prospect of the property failing to show return for the outlay made. In this way Mr. McMartin was one of the first, if not actually the first, to lay out any considerable sum of money on the development of Cobalt properties.

That his tenacity was well rewarded is now a matter of history. By perseverance and holding on to every point gained he and his associates made a fortune out of their Cobalt interests. Subsequently there came the discovery of valuable deposits in Porcupine, and to these the attention of the McMartins and others were drawn. Here again Dame Fortune smiled bountifully and, in conjunction with his brother, the Timmins brothers and D. A. Dunlap, John McMartin became part owner of the mine that was eventually to become more famous than their first property—the Hollinger.

When the news of the huge potential wealth of the Hollinger deposits began to be bruited about it was received, of course, with a certain amount of scepticism. The expenditure of considerable sums of money in preliminary development work was necessary before any of the actual wealth of the Hollinger could be laid bare. Porcupine properties at the outset had not met with success, and it was predicted that the Hollinger would meet with no more success than other prospects. Under these circumstances John McMartin and his associates hesitated to go into the market seeking public money for development work. They were prepared to stand or fall by their own personal expenditure on the property, and it was not until it was proved beyond the shadow of a doubt that the Hollinger was a real gold mine that the Hollinger Company was actually put on the market. Since those days many fortunes have been taken out of the Hollinger mine, and John McMartin and his original associates, the Timmins brothers and Duncan McMartin's estate still retain control of the company.

Mr. McMartin is also heavily interested in mining properties in British Columbia and in real estate in the Canadian West and Labrador.

Mr. McMartin is a Liberal in politics and, according to recent reports, has been approached with a view to representing in Parliament the constituency in which he resides.—Financial Times.

OBITUARY

Andrew Gordon French, who died on August 16 last at his home at 4 Anne street, Glasgow, Scotland, in his seventy-eighth year, was well known in Nelson, where he spent several years working on the French process for the treatment of complex ores, which treatment the Provincial Government has decided to support financially in the reopening of the smelter at Fairview.

Mr. French, who was a metallurgical chemist, spent most of his life in the study of the treatment of complex ores and was associated with some of the largest smelters in Great Britain, notably in Sheffield, Glasgow and Swansea. While in Swansea he made an important discovery in zinc treatment when he invented a process for the treatment of the Constantine zinc ores, which are mined in the Mediterranean and present smelting problems of a complex nature.

He spent several years in Australia studying the treatment of the complex ores of that country, and was associated with various companies, among which was the Broken Hill Mining Company. His son, Thomas French, of Nelson, has been continuing his father's efforts in the province since the latter returned to Scotland a year ago, and will be in charge of the plant at Fairview, which it is expected will be placed in operation at an early date. Gordon French was twice married and leaves one son by his second marriage.—Daily News, Nelson, B.C.

Announcement has been made that the Hardinge Conical Mill Co. has received an order from the Dome Mines Co., Ltd., of South Porcupine, for two 8-ft. diameter ball mills, which are to take the place of stamps now in use at the Dome Co.'s plant.

It has been reported from Yukon Territory that much road repairing has been done in the Dawson district this season by the Government. Some roads, it is stated, have been widened to 24 ft., others to 30 ft., and made with a good raised crown in the centre.

SPECIAL CORRESPONDENCE

NOVA SCOTIA

Dominion Coal Outputs.—The production of the Glace Bay mines for September was approximately 419,000 tons, compared with 341,935 tons in September, 1914. For the first time in the present year the aggregate outputs to date are greater than for the corresponding period in 1914. To September 30th the production for 1915 totals 3,372,000, compared with 3,340,000 in 1914, showing an increase of 32,000 tons. The three remaining months of 1915 will in all probability show further increases over 1914 figures.

Compared with 1914 the increase in production is not attributable to any increase in the output capacity of the mines, but is due to an improvement in business conditions, and particularly to the increased demand made by the works of the Dominion Iron and Steel Company, now working to full capacity.

Compared with the early summer of 1915 the output capacity of the mines has been woefully diminished by the number of enlistments among the mining population. The production of the Dominion Coal Company's Glace Bay mines has suffered by enlistments to the extent of at least from 3,000 to 4,000 tons per day.

As forecasted in these columns several weeks ago, the monthly contribution of the employees of the Dominion Coal Company to the Canadian Patriotic Fund is steadily mounting towards the desired figure of $1,000 per month. The contributions in September totaled $876, and in October it is probable that the collections will reach well over $900, which will bring the contribution of the Dominion employees during the first year to approximately $8,000. The officers of the Cape Breton branch of the Patriotic Fund have had some anxious hours in endeavoring to meet all the claims made upon the fund, and they gratefully acknowledge that the contribution of the Dominion employees has come to be regarded as the mainstay of the Fund, and as a source of regular and ample supply without which the Patriotic Fund Committee would be badly embarrassed.

In addition to the Patriotic Fund collections, the workmen of the Dominion Coal Company have given generously to the fund for the purchase of machine guns, and although the total of the contributions made is not yet quite complete, it is certain that the amounts subscribed will reach $8,000, or sufficient to provide eight guns.

Men, money and guns make an excellent combination with which to oppose the enemy, and in the provision of these requisites the employees of the Dominion Coal Company do not intend to be behind hand. As they say in Cape Breton, the miner is "a good provider."

NEWFOUNDLAND

The marble quarries owned by the Colonial Mineral and Trading Co., Ltd., situated at Little Canada Harbor, Canada Bay district of St. Barbe, are doing excellent work the present season. These are the first marble quarries to be worked in Newfoundland. Although in operation only about two months substantial progress has been made. A good plant has been installed, the initial difficulties have been overcome, and some first-class material has been turned out. The company hopes in addition to being able to supply all local demands to make large shipments abroad in the near future. The company's property contains sixteen hundred acres, and is said to contain several million tons of pure white marble of an excellent quality. The property originally was owned by Newfoundlanders, who sold it to a party in England, who is financing and working it at present. Apart from this particular marble deposit all our geological reports unmistakably point to the fact that Newfoundland has many other large marble deposits only needing development.

Our American friends have recently become very much interested in the immense gypsum deposits of Newfoundland, and a company has been recently formed in Boston, Mass., to operate one of those deposits. Immense deposits of this material surround St. George's bay and the Codroy rivers, West Coast, Newfoundland.

An attempt was made a few years ago to work some of these deposits, and from 1891 to 1894 the customs returns show that $4,300 worth of gypsum was shipped abroad; but since then no shipment has been made. In view of the fact that large quantities of gypsum are mined and shipped yearly from Nova Scotia, Cape Breton and the Magdalen Islands to the United States markets, and the uses and demands for this material are growing larger every year, there is every reason to hope that the gypsum beds of Newfoundland will ere long become an important factor in her industrial life.

Unabated activity continues in the iron mines of Bell island, owned by the Dominion Iron and Steel Co. and the Nova Scotia Steel and Coal Co. The largest output of ore since the opening of the mines went forth last week. Day and night the work proceeds, something like 2,000 men being employed. Every day sees one or more ships at the different piers loading ore for the smelting works at Sydney, C.B., or for the English and American markets.

The workings of these great mines are extended to a distance of two miles or more out under the bed of the ocean, two miles from the Island under Conception bay. The great tunnels or shafts which extend beneath the ocean's bed are electrically illuminated. They are stupendous feats of engineering, and a lasting monument to the ability of those engineers whose work it is.

What promises to be another very valuable iron ore mine is the "Snow's Pond" deposit, situated near Brigus, Conception Bay. The property is owned by the Port-de-Grave Mining Syndicate, Ltd., the personnel of which comprises some of Newfoundland's most prominent commercial men. The president of the company is R. B. Job, of the firm of Job Bros., Ltd., and the directorate consists of Hon. John Harris, president of the Newfoundland Savings Bank, and President of Legislative Council of Newfoundland; Hon. John Harvey, of the firm of Harvey & Co.; John Munn, manager of the Newfoundland branch of the mercantile firm of Bowring Bros., Ltd., and J. W. McNeilly, clerk in Department of Forest and Mines. Work on the property has been going on very successfully the past twelve months. Two shafts have been sunk and some diamond drillings made in testing out the extent of the body, the following is an assay of the ore: [illegible] 0.018 phosphorus, 0.11 manganese.

It may properly be called a limonite ore, not hematite. The Bethlehem Steel Co. is said to be negotiating for a purchase of the property, and its engineer, Willard L. Cummins, spent several days on the property very recently.

Information has just been received of the discovery of a very rich deposit of copper ore, bornite, or peacock copper, in Northern Labrador.

The order has gone forth that the Dominion Iron & Steel Co., one of the companies operating the iron mines of Bell Island, intend to carry on operations in full force all winter, and will employ the maximum number of men in the mines. Preparations are now being made to work No. 3 slope, which has lain idle the past eight years; additional machinery is being erected and tram tracks are being laid, giving employment to an additional number of men. A new slope is to be opened, known as No. 4, on the western end of the island, where there is another large deposit of ore. It is said the work of driving No. 4 will entail some of the greatest feats of engineering that have ever been undertaken by the company.

The amount of ore mined by both Dominion and Nova Scotia companies and shipped each week, shows no decrease as the season advances, and with the large demand for iron in the foreign markets, both companies are making a supreme effort to keep the supply up to a full standard, and be in position to meet all emergencies. It is thought that by the spring of 1916 the demand will be still larger.

Recently some of the newspapers of this country have been commenting adversely upon the policy of allowing all this raw material to be shipped abroad, from which Newfoundland they say only gets the "skimmed milk." The contention is that the ore should be smelted in this country, thus giving additional employment to the people, with increased prosperity to the people in general.

It was reported this week that one of the iron ore prospects of Conception Bay was bonded to a company, owner of large iron mines in Duluth, Minn., U.S.A., and that operations on a large scale would commence shortly.

Work in all the Newfoundland copper mines is going on steadily, and each week sees a shipment or two of copper ore to England or the United States. Last week a small cargo of this ore was shipped to New York from the copper mines of York Harbor, Bay of Islands—one of the many copper mines of this country which has been closed down for a number of years.

It looks as if the company which is to operate the gypsum deposits at St. George's district intends doing things on a large scale. The plant when installed will cost $400,000 and the company contemplates shipping one million barrels of manufactured material yearly to the United States. Contracts have been signed with several large firms in different parts of America, who yearly dispose of large quantities of this material.

Several enquiries from England and the United States have recently been made to the Department of Agriculture and Mines for deposits of antimony. It is said that the antimony mine at Moreton's Harbor, Notre Dame Bay, which has not been in operation since the year 1900, is now to be opened up again by an American company. In a report on the minerals of Newfoundland made by Jas. P. Howley, Esq., F.G.S., in the year 1898, he says: "I visited the antimony mines at Moreton's Harbor last spring and a close examination of the property convinced me that it was a valuable deposit." The price of the ore at that date, Mr. Howley says, was $80 per ton, which is about the same price quoted at present, though for many years past the price ranged from four to six cents per pound.

The shipments of manganese ore from the workings at Brigus, Conception Bay, during the past summer must have proved satisfactory, as report has it that the property has recently been sold to the Bethlehem Steel Works, Philadelphia, U.S.A.

COBALT AND SOUTH LORRAIN

Kerr Lake Co.—The annual report of the Kerr Lake Mining Company has just been issued and shows that on August 31st there was still a deficit on the year's working after dividends had been paid, but since dividends still amount of $620,000 a year, this is a remarkably good record for a company that has already paid $5,820,000 in dividends. It is also satisfactory to note a considerable decrease in the cost per ounce. The total cost per ounce amounted to 21.45 cents, a considerable decrease over that of last year. Mr. Adolph Lewisohn, president of the Kerr Lake, points out that reduction was principally due to the saving in the cost of mining, which was reduced from $5.09 to $4.15 per ton. This reduction in costs almost counterbalanced the reduction on account of lower price of silver.

Mr. Robert Livermore, manager of the company, points out that ore put in sight during the year was less by 1,526,300 oz. than the ore produced. The estimated ore reserves amounted to 4,172,400 oz., of which 2,596,400 oz. was of high grade. This estimate is known to be quite conservative, and as in the past the actual production will probably exceed it. Mr. Livermore is not at all optimistic as to the prospect of finding more ore. He says that the lake bottom has been well explored and the blocks remaining unexplored are all small. Development in the diabase and Keewatin formations in the south of the property have so far not been encouraging. Nevertheless the Keewatin vein is still very strong and regular, and it is hoped that further development both in sinking and raising will open other ore. The balance for the year amounted to $891,868, a reduction of $69,225. This reduction can be attributed solely to the lower price in silver. It is noted in the report that the Kerr Lake Mining Company has purchased 837,400 shares of the Caribou Cobalt Mines Company for $50,000. This gives the Kerr Lake control of the old Drummond mine, comprising 70 acres of property about one-third of which is in the conglomerate. This conglomerate area has been pretty well explored and mined out.

The Lewisohn interests in control of the Kerr Lake Mining Company have decided to take up their option on the old St. Anthony mine in the Sturgeon Lake country. Mr. M. C. H. Little, who sampled this property for them, has been sent from Cobalt to take charge. The St. Anthony is one of the best known of the older gold mines of the province. From it some very spectacular ore has been taken, and it has been sampled again and again by various companies and for reasons not connected with the physical condition of the mine it was turned down. There is a mill on the property, but it is so antiquated that it is not possible to obtain anything better than 50 per cent. extraction, and if the Lewisohn interests do finally decide to take up their option they will certainly have to build a cyanide mill.

Nipissing Mining Co. have again been in luck in securing the extension of valuable ore bodies from neighboring properties. In the last monthly report it is

stated that "ore of quite good width and assay has now been exposed in the Cobalt Lake fault at our line, by the Cobalt Lake Mining Co. This development is on the 285 ft. level. Steps will be taken in the immediate future to develop this ore on the Nipissing side of the line. The orebody referred to has already been developed on three levels by the Cobalt Lake. It is remarkable ore and is 26 inches wide in many places of 2,000 oz. grade. It was known some weeks ago that this ore would probably pass into the Nipissing, but outsiders did not realize that it would occur so soon. This is undoubtedly the explanation of the strength of Nipissing in the last month. The production for the month was within a few thousand dollars, the same as last month. The Nipissing shows no disposition to raise production to its old level, although they are in the market for all the high grade ore that they can get for their high grade mill. The production for the month was $178,484, and bullion shipped from Nipissing and Customs ore amounted to $120,967; of this amount of production, about one-third was produced from high grade ore.

Temiskaming.—For the first time for two and a half months the drills at the Temiskaming mine were used for stoping ore. Previously they had all been used in development. A 34 to 42 ton car, containing over 250,000 oz., came from high grade ore developed at various portions of the old mine. To fill the car five tons of remarkable ore was broken in two rounds from the new vein at the 500 ft. level.

PORCUPINE, KOWKASH, BOSTON CREEK

Kowkash.—The fervor of the Kowkash rush has subsided. There was a period when it seemed likely that the whole camp would be neglected after the snow had fallen and prospecting had become difficult, but discoveries made about forty miles west of Kowkash have led to the continuance of interest in this particular portion of the gold fields. Several well-known prospectors in Porcupine have brought down samples which have been checked and re-checked in Porcupine assay offices. The results were surprising, since the quartz did not show any gold; in two cases assays ran to almost $50. As a consequence a number of prospectors who were prepared to resume their ordinary work in the mines have returned to the bush and will probably remain there this winter. Around the Dodds claim there is some assessment work being done.

Boston Creek.—The rich syndicate of New York capitalists who are in control of the Lorrain property at Boston creek have decided to proceed forthwith with the installation of machinery and a vigorous campaign of development. Considerable work has already been done on the surface on the rich Alexo vein. It has been stripped for 450 ft. Two shafts have been sunk 250 ft. apart. The shafts are respectively 28 and 30 ft. deep. On the surface where the ore has been sampled the pay streak is 12 in. wide, but there is little doubt that the vein will carry sufficient enrichment to enable a good stoping width to be obtained. There is much gold visible in the ore, but it is very fine. There is a little molybdenite and it is rich in sulphides. Sampling of the vein gives very satisfactory results. Across one end of the shaft grab samples gave a return of $41 a ton; across the other the returns were even higher. At the bottom of the 30 ft. shaft there is a very remarkable striation of free gold.

The only other claims upon which sufficient surface work has been done to justify any importance being attached to it is that now under option to the Dominion Reduction Co. The orebody here is white and glassy quartz, 20 or 30 ft. wide. It is not anticipated that the ore will run more than five or six dollars, if it does stand up to that average. The Dominion Reduction Co. is determined to put on a plant and start work at once. The country is very promising, and quite a number of prospectors are working in the townships of Pecaud, McElroy and Boston itself. The T. & N. O. Ry. Commission has decided to place a station at the settlement near Boston creek and lay a spur for the handling of supplies.

Imperial.—A very promising discovery has been made on the Imperial mine in the township of Deloro. This old prospect has resumed operations under Mr. Taylor, the president of the company. From the drift on the low grade orebody a couple of shots were put into the hanging wall. These shots revealed the presence of a much higher grade of ore than had previously been discovered in the mine. There is some free gold, but the ore is chiefly notable for its sulphide contents. Although no careful sampling has been done as yet the assays are remarkably good. The orebody is about 8 in. wide. The drift will be continued to develop it and discover if there is any considerable depth to it.

Recruiting in Porcupine.—Lieut. Alec Smith, one of the first engineers to make his home in the Porcupine camp, has been very energetically recruiting for the Pioneer Regiment which Col. Davis is forming in Canada. With the able assistance of Mr. Globe and other members of the Hollinger staff, a recruiting rally was inaugurated with the results very gratifying to the patriotism of the Hollinger staff. Four prominent members of the Hollinger staff have enlisted. Three go with the Pioneers and one has gone to train with the Aviation Corps at Toronto. Many electricians have volunteered, and a fair percentage of the best men on the Hollinger pay roll will go to the front. Lieut. Smith will take at least 80 men out of the Porcupine camp for his regiment. He already has over 30 awaiting him at Haileybury, and more men are coming in for it, as the Pioneer Regiment is very popular. Capt. R. P. Rogers is also recruiting in the district for the detachment to the Royal Engineers, which he will command. Four well-known mining men have been [illegible] officers and non-coms in this Imperial contingent. All men enlisted are miners. Preference will be given to those who have had experience in soft rock, and it is understood that tunneling will be the particular work of this corps. The corps will be mobilized at Pembroke, and will be sent to the front not more than two or three weeks after recruiting has been completed. Capt. Rogers wishes to get three hundred men for his company from the north.

BRITISH COLUMBIA

An announcement of much interest to miners as well as to other workmen was made in Victoria on September 30, namely, that the Provincial Government has appointed a committee to inquire into the working of the recent Workmen's Compensation Act in force in Eastern Canada and the United States. The members of the committee are Mr. Ernest A. Pineo, representing the Government; Mr. David Rob[illegible] of Robertson & Hackett, Vancouver, for the

employers of British Columbia, and James H. McVety, representing the Trades and Labor interests of the Province. This committee is to at once enter upon its duties, and it is understood that the members propose visiting those provinces that have in force legislation of the kind under review; also, that they will tour neighboring States with the object of also ascertaining what has been done in them in this connection, and whether the measures adopted are giving satisfaction to those chiefly affected by them. The chief object of the committee's labors is to obtain information to embody in a report to be made to the Provincial Government to assist it in framing legislation along the best lines ascertainable. Last session the Government placed before the Legislature a draft of a proposed Workmen's Compensation Act, but nothing was done toward adopting it.

East Kootenay.

Fort Steele Division.—Comparatively little is known of a number of copper claims in the part of this division known as the St. Mary River section. The publication early last month in the Cranbrook Herald of an account of a visit paid by Cranbrook men to the mining properties of the Evans Brothers has drawn some attention to this practically undeveloped part of East Kootenay. The only information given in the Minister of Mines Report for 1914 concerning this part of the division, was as follows: "The St. Mary River section also received some attention, and it is understood that the large low grade copper deposits are to receive a thorough inspection and sampling to determine their economic value. Some of these deposits cannot be described as being in ledge form, but apparently are part and parcel of the formation and are probably 'sills.'" Mr. Stuart J. Schofield, of the Geological Survey of Canada, who spent the field seasons of several successive years (1909-1913) in East Kootenay, included the following brief notice of two of the copper properties under notice in his report on the Geology of the Cranbrook Map-Area:

"**Evans Group of Claims.**—The Evans group of claims, owned by C. and W. Evans, of Marysville, is situated on the western slope of Evans mountain, at an elevation of about 6,000 ft. The mountain is composed of easterly dipping Aldridge quartzites intruded by diorite sills, the upper one forming the summit of Evans mountain. The lower claims contain a tunnel 200 ft. long, driven into a low grade orebody of the differentiate type contained in the gabbro sill about 400 ft. thick and forming the lowest of the three sills. The ore consists of pyrrhotite and cupriferous pyrite, impregnating a coarse grained hornblende granite. The upper claim contains a fissure vein about 4 ft. wide, striking N. 45 deg. E. in a sill of normal hornblende gabbro, which forms the middle of the three sills. The ore consists of chalcopyrite, pyrite and some pyrrhotite and native copper in a quartz calcite gangue. Work is being pursued on both groups of claims with a view to determine the size and relation of the two types of desposits.

"**McKay Claims.**—The McKay claims are situated on the northern slope of Whitefish creek and about seven miles from where it joins the St. Mary river. The country rocks consist of Aldridge quartzites intruded by hornblende gabbro sills, all dipping at an angle of 65 deg. to the northeast. The vein, 8 ft. wide, which occupies a shear zone in the hornblende gabbro, strikes S. 85 deg. W. and dips 78 deg. to the south. That the fissure is a shear zone is supported by the alignment of the feldspars in the hornblende gabbro parallel to and in close proximity to the surface of the fissure. In tracing the continuation of the vein into the underlying quartzites, it was seen to pinch out within 8 ft."

West Kootenay.

Trail.—Ore shipments to Trail from district mines were about 3,000 tons higher for four weeks ended September 23 than for a like period to August 26. There was a smaller output from mines in both Ainsworth and Slocan divisions, but this was more than compensated for by an increase of nearly 4,000 tons from Rossland mines. The totals for the two periods, respectively, were 27,974 tons for four weeks ended August 26, and 30,976 tons to September 23.

An addition to the blower room at the smelting works is about completed. The erection of a building for the zinc-saving plant to be put in here is in progress. The installation of plant will follow quickly, for it is intended that the production of zinc shall be commenced before the end of this year.

Zinc Ores at Nelson Fair.—Prof. Arthur Lakes recently contributed to the Nelson Daily News an account of exhibits at the local Annual Fair that attracted his attention. He wrote, in part: "Turning to the very creditable display of minerals, I was particularly interested in the white zinc crystals and stalactitic masses from the zinc discovery at Salmo. The white crystals are especially fine, the finest I have ever seen, and the stalactitic aggregations, like bunches of grapes, or what geologists call botryoidal (grape) deposits, were specially interesting, showing that this crystaline secondary deposit, very like deposits of botryoidal chalcedony or agate in cavities, and some lime stalactites or stalagmites in caves, was deposited by water, hot or cold, probably the former, which, percolating through original deposits of black-jack or sphalerite, dissolved that mineral and carried the solution down into open cavities in the rock and redeposited it in the altered chemical and crystaline form in which it is to-day found in such unusually large quantities in the mine at Salmo. The ease with which the usually refractory zinc mineral can be treated when in this altered mineralogical form is well known and appreciated by metallurgists, and the discovery bids fair to be one of the most valuable and important in British Columbia. Another peculiarly interesting feature was that of the zinc spelter produced at the Trail smeltery by an electrolytic process. There were many other good displays—of copper and gold and silver mineral, and I was also glad to see the handsome native grey crystaline marble there represented by large and well-polished slabs."

In connection with the zinc exhibit to which Professor Lake referred, it may be mentioned that a few days earlier the Daily News printed some information relative to the property from which the fine specimens exhibited came, as follows: It is reported that a remarkable find of zinc ore was made last week at the Zincton mine, near Salmo, in the southern part of Nelson mining division, when a crosscut was driven into a large body of ore at 200 ft. vertical depth. Mr. P. F. Horton, who was formerly interested in the mine, last night brought to the city samples of the ore for exhibition at the Nelson Fair, and he stated that where the strike was made the orebody shows a width of 7 ft., but its full extent had not yet been determined. The ore is said to assay 46 per cent. zinc. The Zincton mine and the adjoining H. B. property were last July taken over by Mr. R. K. Neill, of Spokane, Washington, and both are being operated by him. The

strike is credited to him as a result of his efforts to further develop the Zincton mine. This year the H. B. and Zincton mines have together shipped to Springton, Illinois, between 3,000 and 4,000 tons of zinc ore averaging between 30 and 35 per cent. zinc. Mr. Horton states that a carload of the newly discovered ore has already been taken out. Twenty-five men are employed on the two properties.

The Zincton, H. B., Leadville, Aspen group, and other mineral claims in which lead and zinc ores have been found, are on Deer creek, a tributary of Sheep creek, from which latter stream the neighboring lode-gold camp took its name. The Deer Creek properties are eight to ten miles from the Nelson-Spokane Railway at Salmo, and ore for shipment has to be hauled that distance in horse-drawn wagons. On a mountain on the opposite side of the Sheep Creek valley, to the southward, is situated the Emerald lead mine, while a few miles to the south-east, above Lost creek and 14 miles from Salmo, is the Molly molybdenite group now being developed by a Vancouver syndicate, which has announced its intention to put in a small concentrating plant with which to make a marketable molybdenum product.

Vancouver Island.

At the end of September, Mr. Thomas Richardson, M.P. for Whitehaven, England, and Mr. Robert Baird, of Glasgow, Scotland, arrived in Victoria, Vancouver island, where they interviewed the Premier, Sir Richard McBride, who is also Minister of Mines for British Columbia, who promised to give them all the assistance he can toward the attainment of the object of their visit, which Mr. Baird outlined to a representative of a local newspaper, as follows: Coal miners being needed in large numbers in Great Britain at the present time, and requisitions for miners having been received from coal mining companies operating in Cumberland, Yorkshire and Scotland, it had been arranged to endeavor to facilitate the return to Great Britain of a number of miners who had made representations to friends in the Old Country that they were out of work on Vancouver island and without means to provide for their transportation back across Canada and the Atlantic. Officials of Miners' Unions in Great Britain having been informed of the position, had taken the matter up with mine owners, who, in turn, placed the information together with a statement of their need of men before the Imperial Government, and, as a result, a commission had been appointed to visit the Canadian West and place before the unemployed miners the conditions on which assistance will be given them to return to Great Britain. These conditions, as published, are: All wishing to return will be required to register. Their competence will be thoroughly investigated. If it shall be found that there are of the class for which there is a great demand in Great Britain at present, they will be asked to formally agree to the repayment of the cost of their transportation to the respective places of their future employment, the money for defraying which is to be advanced by the Government. To the first place the company which hires them is to pay the Government the man's or men's traveling expenses, the latter, in turn, will pay their employers by weekly instalments, based on the number of days a week they shall work. Five days will be counted as a full week; if less time is worked, the deductions will be proportionately less. It is expected that from 100 to 200 first-class men will be obtainable from among the miners on Vancouver island now unemployed, and Messrs. Richardson and Baird expect to remain some time on the island making the necessary arrangements for the removal of the men to the Old Country. Mr. Richardson is known to a number of the local coal miners, for he visited Nanaimo two years ago, so was chosen as the representative of the British Miners' Unions, while Mr. Baird represents the coal mine owners.

COBALT SHIPMENTS.

Ore shipments for the week ending October 8th were as follows:

	Pounds.
Mining Corporation	248,334
Nipissing	130,585
Dominion Reduction	88,000
Temiskaming	63,354
Beaver	61,083
	591,356

Bullion shipments were:

	Bars.	Ounces.	Value.
Mining Corporation	17	21,733	$10,632
(Omitted last week.)			
Nipissing	202	250,790	120,976
Mining Corporation	14	17,579	8,777
O'Brien	31	31,758	16,514
Total	264	321,862	$156,901

Bullion shipments for the year to date are as follows:

Mine.	Ounces.	Value.
Nipissing	4,450,391	$2,182,428
Dominion Reduction	654,888	321,988
Crown Reserve	292,670	145,000
Caribou Cobalt	80,683	40,332
O'Brien	403,005	201,206
Buffalo	440,081	212,500
Crown Reserve (Silver Leaf)	19,000	9,500
Mining Corporation	175,133	86,188
Trethewey	2,321	1,148
Miscellaneous	2,293	1,126
Total	6,520,467	$3,201,418

CROW'S NEST PASS COAL

The Crow's Nest Pass Coal Company has wiped out its indebtedness and has a comfortable credit balance in the bank. It is stated on good authority that a dividend will be declared, likely at the rate of 4 per cent., for coming before Christmas. The coal output of the company has been restricted during the past couple of years because of hard times in the West, but economies have been initiated on an effective footing. At present the company is earning 8 per cent. on the stock.—Financial Times.

LE PAS GOLDFIELD.

Mr. R. B. Watson and party left Toronto last week for Le Pas where Mr. Jack Hammel has located an orebody containing gold and copper.

DAVIDSON.

The Davidson property in Tisdale Township, Porcupine district, formerly under lease to the Crown Chartered Mining Company, has been acquired by a Toronto syndicate and will be examined shortly.

MARKETS

STOCK QUOTATIONS.

(Courtesy of J. P. Bickell & Co., Standard Bank Building, Toronto.)

October 8, 1915.

New York Curb.

	Bid.	Asked.
Alaska Gold	34.25	34.50
British Copper	.50	1.00
Braden Copper	9.62½	9.75
California Oil	317.00	320.00
Chino Copper	48.75	49.00
Giroux Copper	.50	1.00
Goldfield Cons.	1.31¼	1.43¾
Green Cananea	40.00	41.00
Granby	86.87½	87.25
Inspiration Copper	45.75	46.00
International Nickel	216.00	218.00
Miami Copper	34.87½	35.00
Nevada Copper	15.12½	15.75
Ohio Oil	155.00	157.00
Ray Cons. Copper	26.87½	27.00
Standard Oil of N. Y.	406.00	408.00
Standard Oil of N. J.	480.00	....
Standard Oil (old)	14.50	....
Standard Oil (subs)	1050.00	....
Tonopah Mining	5.25	5.50
Tonopah Belmont	3.50	3.75
Tonopah Merger	33.00	38.00
Yukon Gold	2.25	2.50

Porcupine Stocks.

As of Oct. 9, 1915.

	Bid.	Asked.
Apex	.03	.03½
Dome Extension	.25	.26
Dome Lake	.21½	.22½
Dome Mines	.21	.23
Foley O'Brien	.32	....
Hollinger	.25	.26
Jupiter	.11½	.12¼
McIntyre	.47¼	.47½
Moneta	.07½	.08
Pearl Lake	....	.00⅜
Porcupine Gold	....	.00½
Porcupine Imperial	.06	.06¼
Porcupine Crown	.75	.79
Preston East Dome	.05¼	.05½
Porcupine Vipond	.69	.71
Porcupine Tisdale	.01¼	.02
West Dome	.09¼	.09½

Cobalt Stocks.

	Bid.	Asked.
Bailey	.04⅞	.05
Beaver	.27½	.28½
Buffalo	.45	.65
Chambers Ferland	.13	.15
Coniagas	4.00	4.50
Crown Reserve	.40	.40½
Foster	....	.04½
Gifford	.01¾	....
Gold Reef	.00½	.00⅞
Gould	.02⅝	.03
Hargraves	.01⅜	.02
Hudson Bay	.20	.24
Kerr Lake	3.50	3.75
La Rose	.48	.50
McKinley	.31	.37
Nipissing	6.90	7.20
Peterson Lake	.21¾	.22¼
Right of Way	.04½	.05
Silver Leaf	.01½	.02
Teck Hughes	.13	.14
Temiskaming	.37½	.38
Trethewey	.12	.16
Wettlaufer	.05½	.06
Seneca Superior	....	.68
Homestakes	....	.20
York Ontario	.02½	.03

TORONTO MARKETS.

Oct. 12, 1915—(Quotations from Canada Metal Co., Toronto)
- Spelter, 18 cents per lb.
- Lead, 6¼ cents per lb.
- Tin, 37 cents per lb.
- Antimony, 40 cents per lb.
- Copper casting, 19 cents per lb.
- Electrolytic, 19 cents per lb.
- Ingot brass, yellow, 13c.; red, 15 cents per lb.

Oct. 12. 1915—(Quotations from Elias Rogers Co., Toronto)—
- Coal, anthracite, $7.75 per ton.
- Coal, bituminous, $5.25 per ton.

NEW YORK MARKETS.

Oct. 8, 1915—Connellsville coke (f.o.b.) ovens—
- Furnace coke, prompt, $1.80 to $1.85 per ton.
- Foundry coke, prompt, $2.30 to $2.60 per ton.

Oct. 8, 1915—Tin, straits, nominal, 32.50 cents.
- Copper, Prime Lake, 17.87½ to 18.12½ cents.
- Electrolytic copper, 17.87½ to 18.12½ cents.
- Copper wire, 19.25 to 19.50 cents.
- Lead, 4.50 cents.
- Spelter, scarce.
- Sheet zinc (f.o.b. smelter), 16.00 cents.
- Aluminum, 55.00 to 57.00 cents.
- Platinum, soft, $50.00 to $54.00 per ounce.
- Platinum, hard, $54.00 to $58.00 per ounce.
- Quicksilver, $92.00 per 75-lb. flask.

SILVER PRICES.

September—	New York. cents.	London. pence.
24	49⅜	23¾
25	49⅛	23¾
27	49⅛	23¾
28	49⅛	23⅝
29	49⅜	23½
30	49½	23¾
October—		
1	49¾	23⅞
2	49⅝	23½
4	49⅝	23½
5	49⅝	23½
6	49⅝	23⅞
7	49¾	23½
8	49⅝	23½

INTERNATIONAL NICKEL.

The Sudbury district is still increasing production while in New York the market price of International Nickel has risen to $220 per share. Creighton mine is breaking all records for ore output and the smelter at Copper Cliff and the refinery at Constable Hook are being taxed as never before.

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

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Most of the older reports are out of print, but they may usually be found in public libraries, libraries of the Canadian Mining Institute, etc.

MEMOIRS AND REPORTS:

CANADA
Summary Report of the Geological Survey for the year 1914.
Memoir 74. A List of Canadian Mineral Occurrences, by Robert A. A. Johnston.

NEW BRUNSWICK and NOVA SCOTIA
Memoir 60. Arisaig-Antigonish District, Nova Scotia, by M. Y. Williams.
Memoir 78. Wabana Iron Ore of Newfoundland, by A. O. Hayes.

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Memoir 57. Corundum, its Occurrence, Distribution, Exploitation and Uses, by A. E. Barlow.
Museum Bulletin No. 8. The Huronian Formations of Timiskaming Region, Canada, by W. H. Collins.

NORTH-WEST PROVINCES
Memoir 65. Clay and Shale Deposits of the Western Provinces (Part 4), by H. Ries.
Memoir 66. Clay and Shale Deposits of the Western Provinces (Part 5), by J. Keele.

BRITISH COLUMBIA
Memoir 69. Coal Fields of British Columbia, by D. B. Dowling.
Memoir 56. Geology of Franklin Mining Camp, British Columbia, by Charles W. Drysdale.
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Memoir 76. Geology of the Cranbrook Map-Area, British Columbia, by S. J. Schofield.

YUKON AND NORTH-WEST TERRITORIES
Memoir 50. Upper White River District, Yukon, by D. D. Cairnes.

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Maps 140A and 141A [illegible] Yukon and Porcupine Rivers. Geology.
Map 122A. Upper White River District, Yukon Territory. Topography.

Applicants for publications not listed above should mention the precise area concerning which information is desired.

Maps published within recent years may be had, printed on linen, at the nominal cost of ten cents each.

The Geological Survey will, under certain limitations, give information and advice upon subjects relating to general and economic geology. Mineral and rock specimens, when accompanied by definite statements of localities, will be examined and their nature reported upon. Letters and samples that are of a Departmental nature, addressed to the Director, may be Mailed O.H.M.S. free of postage.

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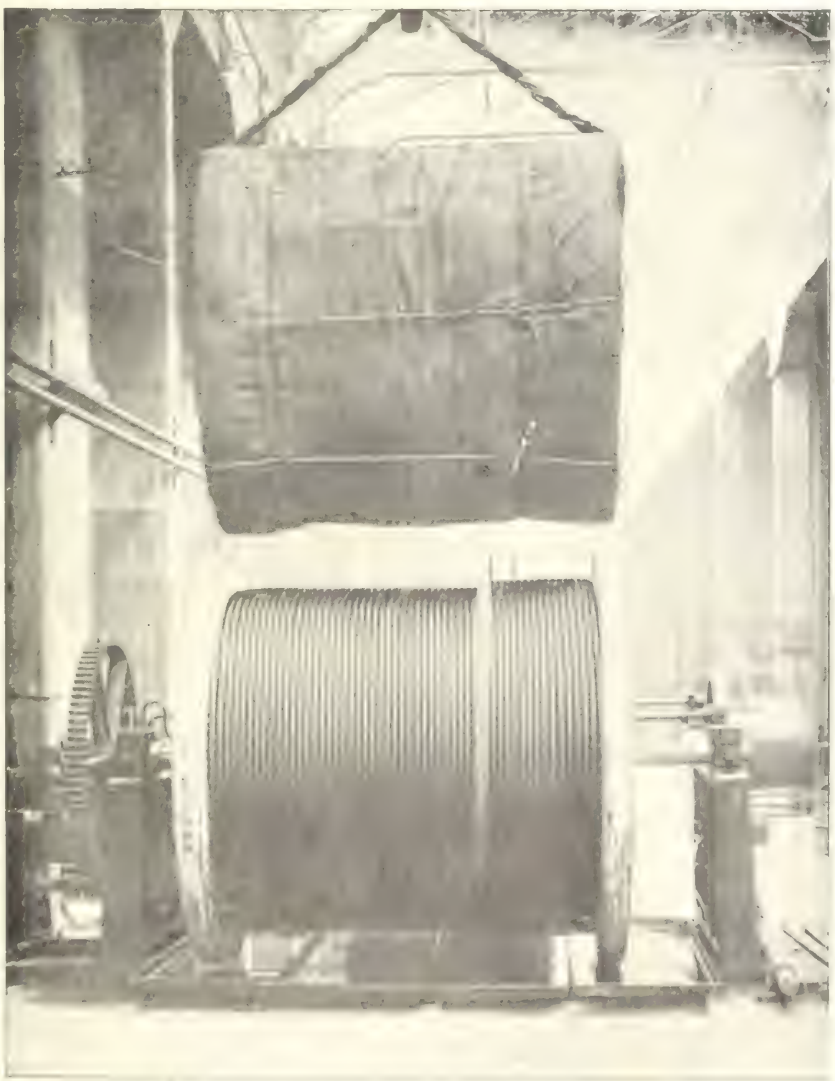

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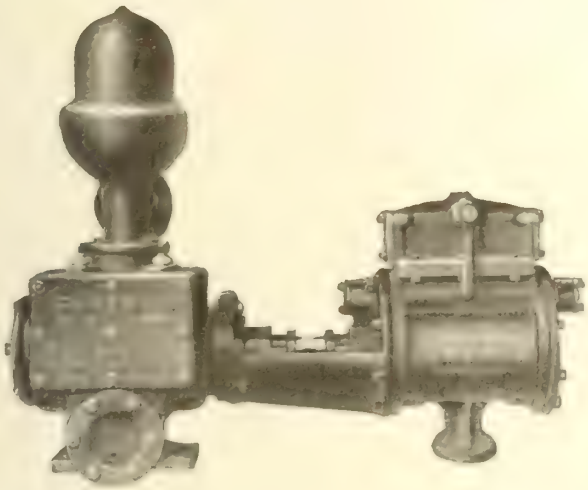

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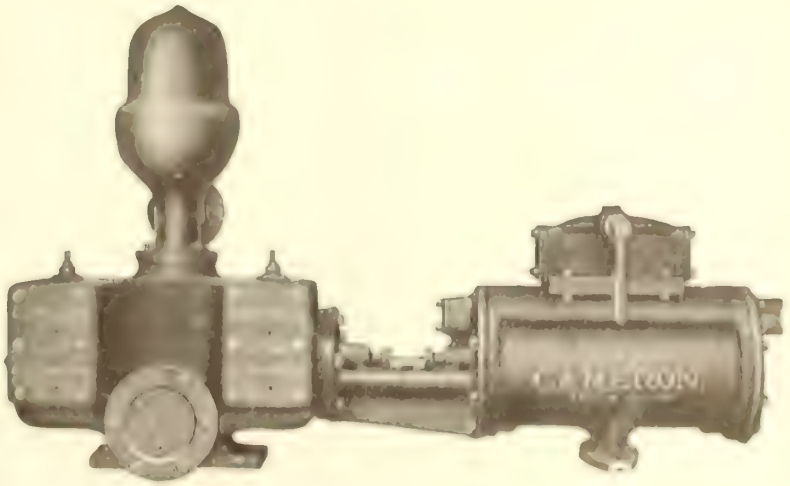

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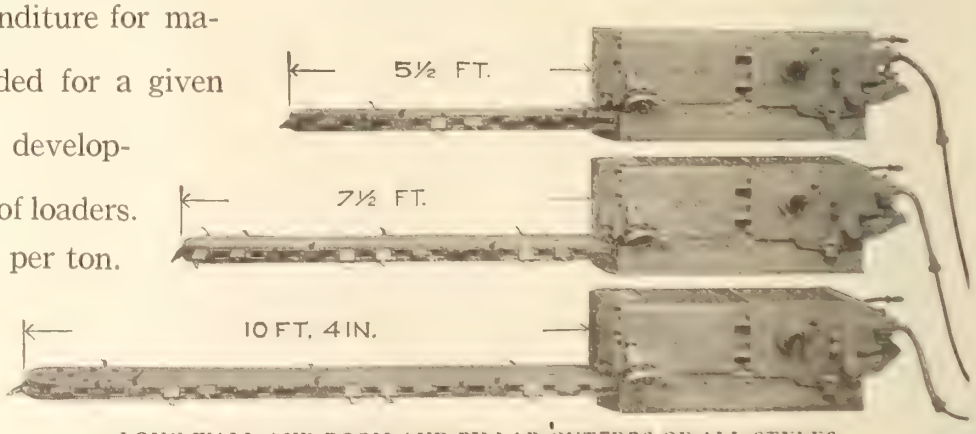

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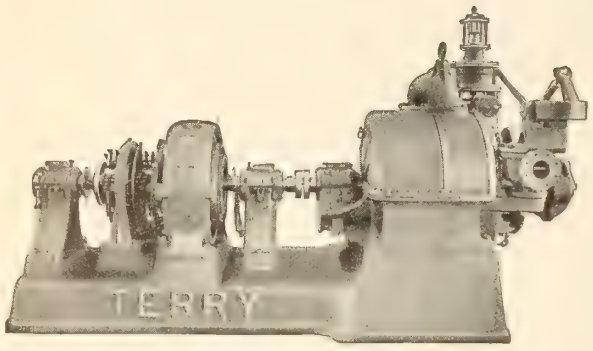

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Application for a lease must be made by the applicant in person to the Agent or Sub-Agent of the district in which the rights applied for are situated.

In surveyed territory the land must be described by sections, or legal sub-divisions of sections, and in unsurveyed territory the tract applied for shall be staked out by the applicant himself.

Each application must be accompanied by a fee of $5 which will be refunded if the rights applied for are not available, but not otherwise. A royalty shall be paid on the merchantable output of the mine at the rate of five cents per ton.

The person operating the mine shall furnish the Agent with sworn returns accounting for the full quantity of merchantable coal mined and pay the royalty thereon. If the coal mining rights are not being operated, such returns should be furnished at least once a year.

The lease will include the coal mining rights only, but the lessee may be permitted to purchase whatever available surface rights may be considered necessary for the working of the mine at the rate of $10.00 an acre.

For full information application should be made to the Secretary of the Department of the Interior, Ottawa, or to any Agent or Sub-Agent of Dominion Lands.

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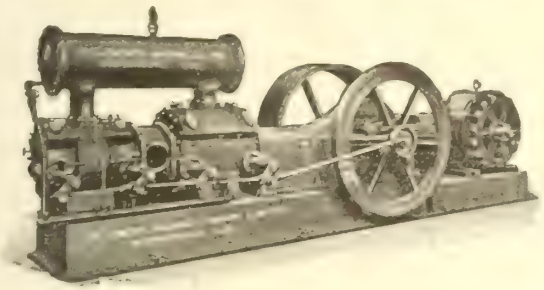

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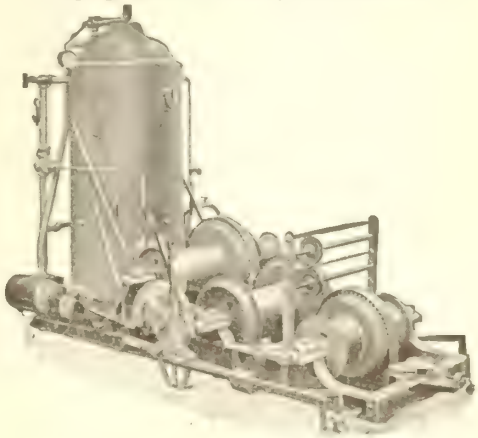

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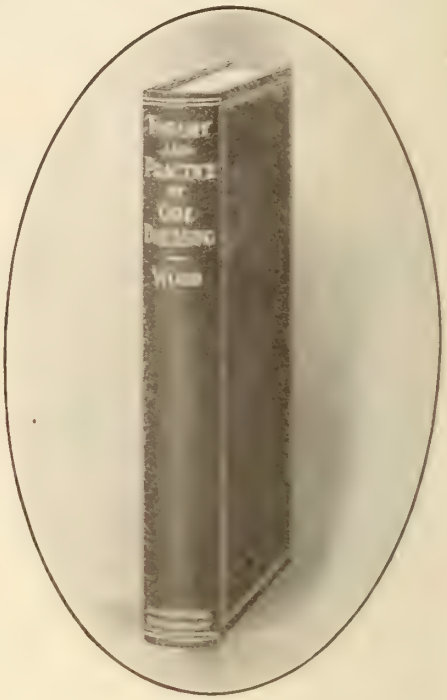

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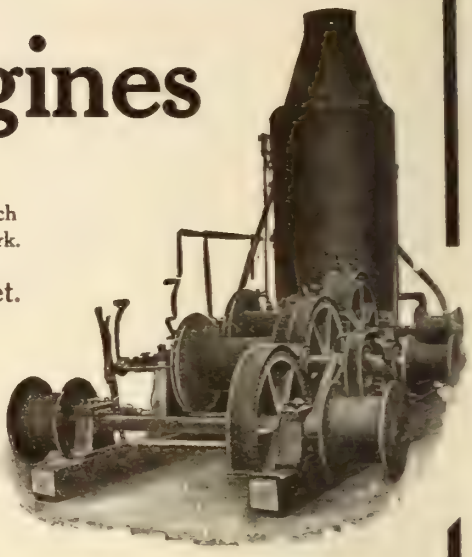

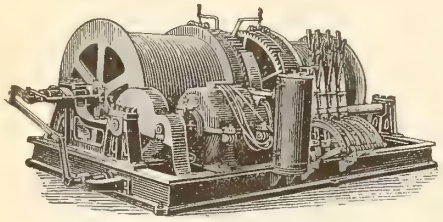

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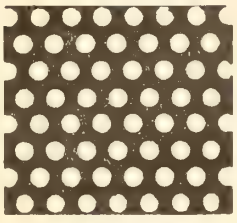

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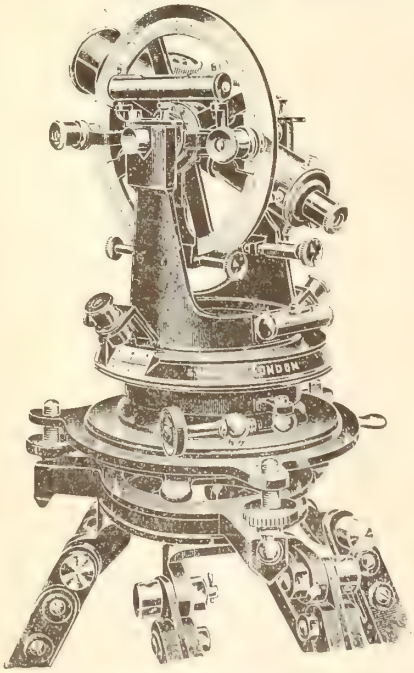

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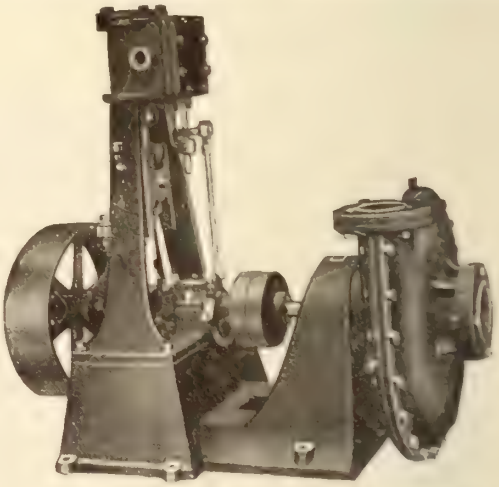

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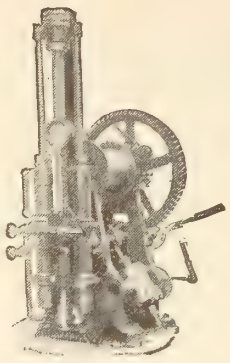

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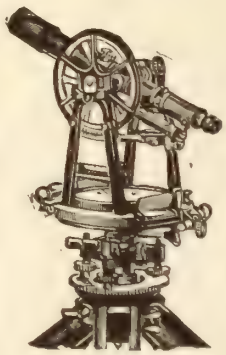

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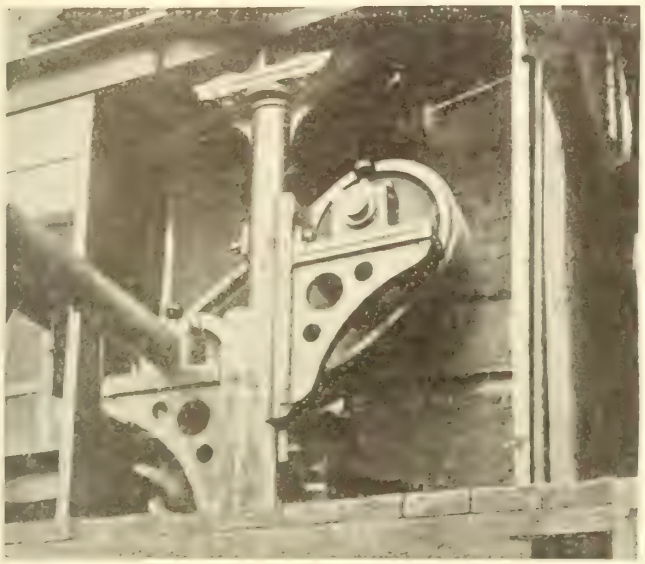

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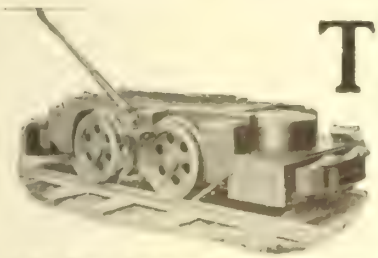

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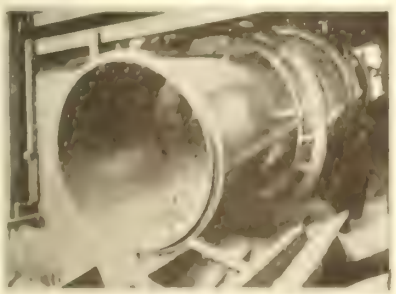

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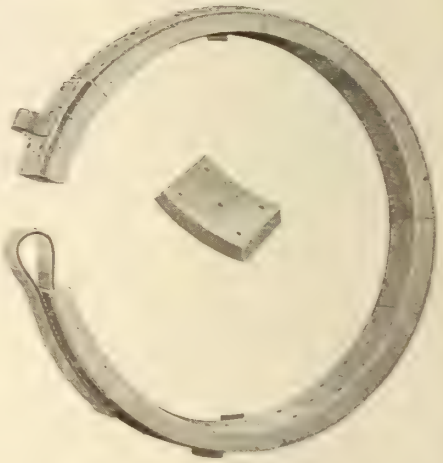

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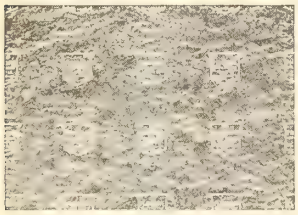

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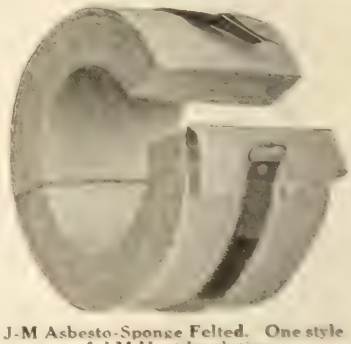

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THE CANADIAN MINING JOURNAL

VOL. XXXVI. TORONTO, November 1, 1915. No. 21

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REGINALD E. HORE

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RESEARCH AND INDUSTRY

In this issue we publish some account of the investigation carried on by Dr. H. T. Kalmus and his assistants in the metallurgical laboratory at Queen's University, Kingston, and by Mr. W. S. Barrows at the plating plant of the Russell Motor Car Co., Toronto, in connection with the problem of electro-plating with cobalt.

Cobalt is one of the chief constituents of the silver ores of the Cobalt district, Ontario.. It is produced in larger quantity than the market warrants, owing to the very limited use which it has found up to the present. It is known to have splendid properties as a metal, but for most of the uses to which it might be put, nickel, which is much cheaper, is satisfactorily filling demands.

The experiments carried on last winter by Mr. Barrows to determine the commercial value of the solutions prepared by the investigators at Kingston, seem clearly to indicate that the advantages of the cobalt solutions over the ordinary nickel solutions are such that cobalt is likely to gradually displace nickel for plating purposes.

In our last issue we published an article by Mr. F. M. Turner on the value of research to industry. The investigation of cobalt and its compounds being carried on for the Department of Mines in the laboratories of Queen's University has had results which go to prove Mr. Turner's contentions. Co-operation between the investigators in their laboratories and the foremen in the shops, such as there has been between Dr. Kalmus and Mr. Barrows, is much needed in Canada.

The Canadian Mining Institute is compiling a list of miners throughout the Dominion who have enlisted for military service. The Secretary of the Institute has been advised that such a list, which should particularize the regiment joined, would be useful to the military authorities.

In order that the list be most useful it should be complete and up to date. It is to be hoped, therefore, that the mining companies will promptly advise the Secretary concerning enlistment of their employees.

The Rice Lake Manitoba district, so again to the front with another gold discovery. According to interested parties this is a world beater. The information so far available is scanty.

The Sudbury district is making a record production of nickel and copper. There are few places which have been so favorably affected by the war. The demand for the metals is not only good, but likely to continue so.

Several months ago the Department of Militia appointed four members of the Canadian Mining Institute to instruct troops in mining methods useful in warfare. At a recent meeting of the Toronto branch, Capt. Jas. McEvoy, without divulging any military secrets, gave some account of the work accomplished. The results obtained were said to be quite satisfactory. There are few soldiers who would not profit by some of the things that the mining engineers are endeavoring to teach them. Among other things, simple and effective ways for tunneling soft ground are very necessary in this war. It is hoped that not only will these soldiers be able to do such work, but that they will do it in a systematic way known to them all. System and uniformity in methods are obtained only by training.

Since the establishment of a really large gold mining industry in Northern Ontario it has often been remarked that some of the older districts might have also been successful if they had been as capably exploited. Notwithstanding such opinions, however, the gold deposits of Western Ontario still fail to attract the attention that do new discoveries in Northern Ontario. An engineer recently returned from the Rainy River district, visited some claims there on which a few pits had been sunk. The dumps at three test pits were sampled and found to contain $14.10, $21.20 and $18.00 gold per ton. The claims are now being more carefully examined.

NOVA SCOTIA STEEL

Scotia's advance followed the announcement that the company had gone forward to unprecedented production levels. There was an important meeting of directors at New Glasgow on Tuesday, following which Col. Cantley stated that the September output and sales were the largest for any month in the company's history. The management are negotiating for large foreign business and to provide increased working capital necessary in view of the greatly enlarged operations of the company, the directors are considering a proposal for the sale of treasury securities which will place the company in an excellent financial position.—Financial Times.

WEST KOOTENAY NOTES

Slocan.—Among the Slocan mines that had for years been inactive was the Galena Farm, situated near Silverton, Slocan lake. Nearly twenty years ago this mine was one that was prominently before the public, press notices of it having frequently been published. It was closed in the nineties, however, and ever since then had been in charge of a caretaker until early this year, when it was acquired by the late Mr. Patrick Clark of Spokane, Washington. The "Spokesman-Review" of that city on October 16 published the following information concerning it:

"The new 100 tons daily capacity mill at the Galena Farm mine, near Silverton, B.C., has been completed, and is ready to be operated, according to John Clark, son of the late Patrick Clark, who returned recently from a trip to the camp. The plant is of the most modern type, and has been designed and equipped especially to treat the Galena Farm ores which, like most of the mineral deposits of the district, have individual characteristics that must be taken into consideration in working out a concentration system. The Galena Farm was taken over several months ago by Mr. Clark under lease and bond from A. W. McCune, of Salt Lake City, Utah, and the plans that he outlined for development and operation of the property are being carried out by the managers of his estate. One of his sons, P. W. Clark, and two of his former business associates, John Bresnahan and M. Sullivan, who had been interested with him in many mining ventures for more than thirty years, are in charge of the mine and mill, but active management devolves upon Mr. Bresnahan, who personally is superintending operations. About 40 men are now employed, but the number will be increased shortly, when three full shifts will be put on in both mine and mill. The metal content of the Galena Farm ores is principally zinc, although there is also good value in lead and silver. An ore shoot 350 ft. long, conservatively estimated to contain 35,000 to 40,000 tons, has been opened ready for extraction of the ore on the 100 ft. level. Another tunnel, starting 60 ft. below the 100 ft. level, to cut the same ore shoot, is now in 750 ft., and drifting will be commenced at that depth as soon as the vein shall be reached. A 6 ft. vein was encountered in the lower tunnel about 365 ft. in, but it is believed that this is an entirely new vein, not connected in any way with the one showing in the upper workings. The output of the Galena Farm was recently contracted for by the American Metals Co., and the concentrate will go to its smeltery at Bartlesville, Oklahoma.

During September shipments of zinc concentrates from Slocan mines, according to a published statement, totaled only 806 tons, against 1,113 tons for the corresponding month of 1914. This September's shippers were the Standard mine, 453 tons, and the Hewitt-Lorna Doone mine, 353 tons. A beginning has been made to again ship silver-lead concentrate from the Ruth mill at Sandon, which plant had been inoperative for more than a year. On October 15, the Standard Silver-Lead Mining Co., owning the Standard mine and concentrating mill near Silverton, declared another monthly dividend of 2½ cents a share on its 2,000,000 shares, this being the company's third monthly distribution of $50,000 since payment of dividends was resumed in August. Announcement was made in a district newspaper a short time ago to the effect that the National Zinc Co. of Bartlesville, Oklahoma, had contracted to take the zinc output of the Standard mine to a total quantity stated to be likely to amount to 16,000 tons during the next year.

Ore is again being shipped from the Queen Victoria copper mine, situated about ten miles westward from Nelson along Kootenay river. The ore is being taken out by leasers, who are shipping their product to the British Columbia Copper Co.'s smelting works at Greenwood.

Shipment of ore in small quantities continues to be made occasionally from properties in outlying camps in Boundary district. Two lots, together 57 tons, were recently shipped from the Sally mine, near Beaverdell, West Fork of Kettle river, and 60 tons from the Union mine, in Franklin camp, North Fork of Kettle river. The former was shipped to the Consolidated Mining and Smelting Co.'s smeltery at Trail, and the latter went to the Granby Consolidated Co.'s works at Grand Forks.

CRUSHING AND GRINDING GOLD AND SILVER ORES*

By L. D. Mills and M. H. Kuryla.

Primary crushing is usually done in two stages: first a jaw crusher breaking from run-of-mine to 6 in., and then cone crushers to reduce this material to 2 in. The Symons disc crusher is a recent machine which is giving good results in crushing from 4 or 6 in. down to 1 or 2 in. This machine is good on hard, brittle ores, but not adapted to wet, sticky ores. Undersize must be eliminated from the feed.

Typical costs of coarse crushing and conveying are given below:

Goldfield Consolidated, Nev., crushing and conveying	$0.046
Belmont Milling Co., Nev., crushing and conveying	0.068
Commonwealth Mine, Arizona, crushing and conveying	0.079
Hollinger Gold Mines, Porcupine, crushing and conveying	0.113

Fine crushing or coarse grinding covers reduction from 1½ or 2 in. to 0.25-in. aperture. The term to be used depends on whether the energy is applied by impact or attrition or both.

The gravity stamp crushing by impact is probably used in 95 per cent. of the cyanide plants of the world. In spite of its unquestioned disadvantages, it continues in favor. There is a tendency in American and Canadian practice to adopt the ball mill, and it is the authors' belief that few, if any, new stamp mills will be built on the American continent.

The economic limit of battery-screen aperture in modern plants is considered to lie between 0.15 to 0.4 in. This statement applies either to American and Mexican all-sliming practice, 70 per cent. or more through 200-mesh, or to Rand practice, 95 per cent. through 65-mesh.

Stamp mill practice has reached its highest development in South Africa. The Nissen single stamp has been received with some favor there, showing one-third greater capacity, per pound of falling weight, and an equal gain in efficiency over the ordinary gravity stamp. Of the six new mills built on the Rand since competitive trials were made, however, only one proposes to adopt the Nissen stamp. In modern Rand

STAMP-MILLING DATA.

Plant	Tons Mil'd 24 Hr.	No.	Dimens'ns	Hp.-Hr. P.T.	Cost P.T.	-100	200
			5ft. x 16ft.				
Mexico Silver Mill				10.8	22.0	98.0	
	245	4	6ft. x 20ft.	44.6	50.0	100.0	100.0
	500			16.8	40.9	99.0	72.3
	500	1	5ft. x 18ft.	2.1	2.6	64.0	50.0
		2	5ft. x 14ft.				
	1500	2		0.5	1.2	87.0	66.0
	585	4	5ft. x 20ft.	16.0	18.8	100.0	90.0
		1	5ft. x 16ft.				
	150	1	4ft. x 20ft.		36.0	100.0	
		4	5ft. x2.2ft.	4.3		87.0	73.4

The efficiency of the closed circuit has been questioned, but the contentions against it are not borne out in practice. As to moisture in tube-mill feed, 38 to 40 per cent. has been generally accepted, and is probably correct for mills discharging within 6 in. of the central axis; but for mills with peripheral discharge, higher moistures will be found advisable. The proportion of tube-mill capacity to stamp capacity has been increased, and costs have been lowered as more work has been thrown on the tube-mill. It is possible that ball and tube-mills in series may supplant the stamp. Various substitutes for pebbles are being investigated, such as hollow cast iron or steel balls, and special polyhedron shapes. The Marathon or rod mill also has been tested with favorable results. Tube-milling costs in the newer plants on the Rand are about equal to stamp-milling costs; 18 to 20 cents per ton milled.

The use of stamps, Chilean mills and tube mills for stage crushing and grinding at the Goldfield Consolidated is unusual, but productive of low cost of operation. Stamps weigh 1,050 lb., crushing through 4-mesh screen; 6-ft. Chilean mills have 30-mesh screens; tube-mills are 5 ft. by 22 ft. Following are costs per ton milled:

				Tube Mills
			$0.018	$0.011
Supplies	0.041			
Power (232 hp.)	0.054	(210 hp.)	0.047	
	$0.134		$0.106	$0.166

Power consumed by stamps, Chilean mills & tube mills—22.5 hp.-hr. per ton milled.

Chilean mills are used at the Portland mill, Cripple Creek, for final grinding where a fine product is not required. Six-ft. Akron Chilean mills run at 36 to 41 r.p.m., using 2.5 to 3 tons of solution per ton of ore. Steel consumption per ton of ore ground is 0.797 lb. gross and 0.692 lb. net. Power consumption per ton of ore in coarse-crushing department is 1.86 h.p.-hr. h.p.-hr. Following are cost data:

	per Ton	
	0.0318	
	0.0163	0.0039

Dry crushing in ball mills is still retained at Kalgoorlie, the data for No. 5 and No. 8 mills, respectively, being as follows: Size, 7 ft. 6 in. in diameter by 3 ft. 10 in. long, and 8 ft. 10 in. by 4 ft. 6 in.; screen areas, 70 and 100 sq. ft.; speeds, 25 and 23 r.p.m.; power consumption, 25 and 60 h.p.; capacities, 40 and 95 tons

*Abstract of a paper presented at the Intermountain [illegible] meeting, [illegible] October, 1915.

per day, the feed being about 2½ in. and the discharge through 28-mesh screen containing from 40 to 50 per cent. minus 200-mesh; steel consumption per ton milled varies from 0.4 to 0.7 lb.; average cost of ball-milling, $0.50 per ton milled.

Wet crushing ball mills are coming into favor with excellent results. They run smoothly and are free from the noise produced by stamps. Recent tests on an 8-ft. Marcy mill showed that when operated in closed circuit on 4-in. maximum feed, the finished product may be kept under 48-mesh if desired. Steel consumption was 0.75 lb. per ton crushed, and power consumption about 12 h.p.-hr. per ton.

Griffin mills and grinding pans, once widely used, are now rarely installed in new plants.

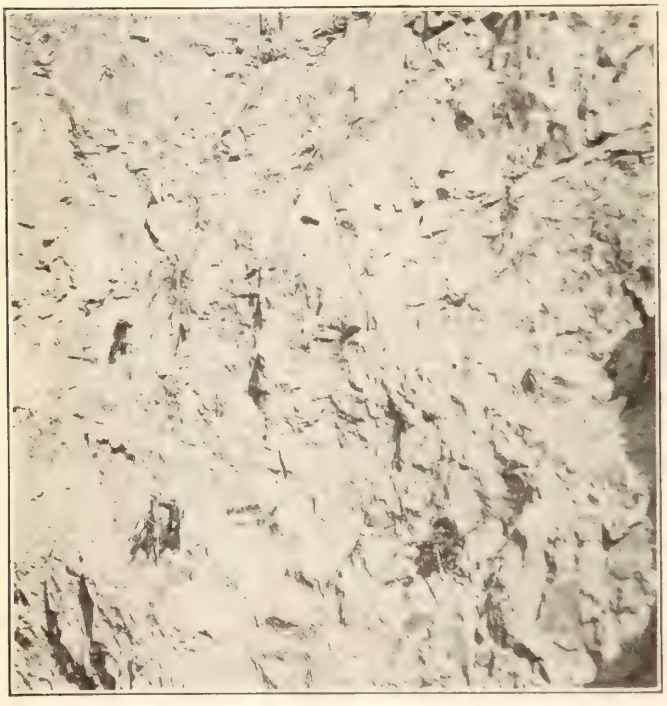
* * *

In the discussion of this paper Mr. Charles Butters predicted that steel balls would displace pebbles for tube milling, as they would permit the use of shorter tubes with smaller diameter, running at a higher speed, with a consequent reduction in first cost and in operating cost. One pound of steel balls is equivalent to three to five pounds of pebbles.

Building roast heaps, for treatment of nickel-copper ore, Copper Cliff

SUDBURY.

Work on the five-compartment shaft at Creighton is being pushed at a very satisfactory rate. The number of men underground in the district is larger than ever. Until recently the district showed a good accident record for 1915, but last week Mining Inspector Sutherland was called from Toronto to be present at two inquests in one day, the victims being a timberman and a miner at Creighton mine.



Milling nickel-copper ore, Creighton

The Canadian Copper Co. has issued an order, effective the 1st November, that all smelter and surface employees will hereafter work an eight-hour shift, instead of ten or twelve hours, at the same rate of wages as for the long hours.

International Nickel in its first statement since the shares were listed shows total earnings of $6,770,707 in the six months ended September 30. In the entire year ended last March the company reported an aggregate income of $7,230,760, which was only $460,000 more than in the succeeding half year.

The company paid out in dividends in the six months $2,168,953 and, after making reservations for depreciation and decreases of mineral resources, a balance remained of $3,398,466. The balance for the preceding year was $309,378.

NIPISSING.

With the payment of current dividend, amounting to $300,000, Nipissing Mines has disbursed to its stockholders since July 20, 1906, a total of $13,440,000, or more than twice the amount of its capital stock of $68,000,000.

News from Cariboo and Atlin indicates that it is not unlikely the placer-gold yield for the 1915 season will be somewhat less than that for 1914. However, until particulars shall have been received from the local Gold Commissioners, it will not be known what the position in this respect really is.

MINING IN THE YUKON*

By J. B. Tyrrell.

Gold.—Gold mining has been the principal and controlling industry in the Yukon up to the present time, the agricultural and other products having been used for the support of the gold miners and those dependent on them. Gold has as yet been mined entirely from gravel deposits, for although it has been found in reefs and ledges in a number of places, none of these have so far been worked at a profit. The history of gold mining in the country, therefore, is the history of its placer-mining, and this has been confined largely to the Klondike district, though gold-bearing gravels have been found on many other streams outside this district, such as the Big Salmon, Lewes, Stewart, Forty-mile, etc. The native gold in nuggets, pellets and dust is found free in the gravels on the banks and bars of streams and in the alluvial deposits that form the bottoms of the valleys. These gravel deposits are classed as placers, but there is a very vital difference between such mines on the tributaries of the Yukon river and other alluvial or placer mines in countries farther south, a difference so great as to put them, from an operative standpoint, in a class by themselves.

The gravel is frozen into a solid mass and remains frozen summer and winter alike, and at the same time it is almost everywhere covered by a layer, from two feet to as much as one hundred feet in depth, of vegetable mould or "muck," which is also frozen into a solid, coherent, icy mass. On the banks of the streams farther south the miner, with his pick, shovel and rocker, or sluice-boxes, can take up the gravel and wash the gold from it cheaply and easily, but here the pick will make little or no impression on the frozen ground. The gravel has to be first thawed by some means before it can be raised, and the development of the most economical methods of thawing it has been a dominant factor in profitable mining in the Klondike.

For two years after gold was discovered by George Carmack on the banks of Bonanza creek mining was almost exclusively confined to the gravel deposits in the bottoms of the valleys, and was performed entirely by hand, with the assistance of such simple implements as the pick, shovel, wheelbarrow and windlass.

Ground Sluicing and Shoveling-in.—Two general methods of mining were in vogue, depending on whether a claim was worked as a pit or "cut" open to the surface, or through a shaft or shafts and tunnels or chambers underground. The first method, usually known as "ground-sluicing and shoveling-in," involves expensive preparation before the pay-dirt can be reached. It is conducted as follows: A narrow ditch is dug in the muck lengthwise of the claim, and a part or the whole of the water from the adjoining brook is turned into the ditch by a wing-dam. The water rapidly deepens the ditch to the level of the bottom of the muck, or the top of the underlying gravel, and the miners pick down the muck and let it from the sides of the ditch into the running water below, by which it is in part dissolved and in part carried away down the stream. As the ditch is thus widened, the water is kept flowing against one side by little dams, and thus an area from one hundred to two hundred feet in length and fifty feet or more in width is freed from its covering of muck, and the underlying sand and gravel is laid bare to be thawed by the sun and warm winds and rain of the remainder of that or the following summer. Of the gravel so exposed the upper portion usually contains so little gold that it is of no value. It is, therefore, shovelled into wheelbarrows and wheeled away and dumped to one side, all the ground being removed until the gold-bearing layer near the bed rock is reached. A dam is then built in the stream some distance above the area of uncovered gravel, which being now lower than the surrounding part of the bottom of the valley, or than the bed of the stream itself, is known as the cut; and a flume is built from this dam to sluice-boxes, which are strung on a proper grade across the top of the cut. Water is turned into the flume and sluice-boxes, and the pay-dirt is then shoveled, usually in two stages, from the bottom of the cut into the sluice-boxes.

Cost of Shoveling-in.—This shoveling-in was a slow and expensive process, for wages were high, even though many of the men employed had never been accustomed to handle a shovel. An average gang of six men, working in a cut and shoveling dirt into the sluice-boxes in two stages, will thus handle from fifteen to twenty cubic yards in a day of ten hours. In some of the richest mines the expense was, of course, a trifling matter compared to the great value of the output. For example, in the summer of 1898, at one mine, a force of six or eight men, working for three shifts of ten hours each, produced eight gold-pans full of clean gold. The owner at that time was obliged by law to pay a royalty of ten per cent. of this gross output, and the return made by him of the value of this deposit was $16,000.

Administration Building, Dawson City

Drifting.—The other method—"drifting"—in vogue in the early days of the Klondike camp, chiefly on claims where the muck and underlying barren gravel were too deep to permit of their being removed economically by the process of open-cutting just described, was conducted as follows:

In one of these shafts, about three feet by six feet in horizontal dimensions, was picked down through the frozen muck to the sand or gravel. As a rule it is not difficult to pick out the muck in blocks of

*Reprinted from "The Yukon Territory," by J. B. Tyrrell, published by the Canadian Mining Institute, 1913, pp. 343-356.

easily; and much of it is so free from grit that it will not even blunt the point of the pick. As soon as the shaft was sunk to the gravel, a fire was built in the bottom of it, and after this fire had burned out, and the gases arising therefrom had risen to the surface, the gravel that had been thawed by the fire, extending probably to a depth of from twelve to eighteen inches, was dug out and hoisted to the surface with a bucket and hand-windlass. Another fire was then built in the bottom of the shaft, the gravel being afterwards removed as before, and so the work went on until bed-rock was reached. One, and sometimes two, fires were lit in a shaft each day. When the bed-rock was reached, fires were built against the face of the gravel, green timber being piled on the dry wood to keep the heat down as much as possible, and the gravel and bed-rock were hoisted to the surface as before and piled up in a dump. During the following spring, when the water was flowing in the adjoining creek, it was diverted into sluice-boxes and led past the dump, the surface of which, as it was thawed by the sun and atmospheric agencies, was scraped off and shoveled into the water in the boxes, the rate at which this pay-dirt could be handled being determined by the rapidity with which the dump thawed. If the dump was large, it might not thaw out thoroughly until well on towards the end of the summer; and, when the creek was a small one, it very often happened that the water in it, supplied by the melting snow of the previous winter, failed and so put an end for that season to the possibility of sluicing.

Cost of Drifting.—Exact accounts were rarely kept in the Klondike in those days, except by the banks, so that it is difficult to determine the precise cost of much of the mining that was then done, but it is safe to say that it varied from ten dollars to twenty-five dollars and more to the cubic yard.

Placer Mining in Summer. Claim 44, Humker Creek

Summer Methods.—Such underground mining, with the help of wood fires, could only be carried on in winter, for at that time of year the air in the drifts, though at freezing-point, was much warmer and lighter than the air above, which was probably 50 degrees lower in temperature, and the noxious gases formed by the fires would quickly rise to the surface and be dissipated; while in the summer the air in the drifts, with its load of noxious gases, being surrounded by frozen ground, was still at freezing-point, and the air above was much warmer and lighter, so that the poisonous gases generated by the fires would not rise to the surface, and men were consequently unable to work in the drifts.

But the miners were determined, if possible, to prospect and work their claims whether the season was summer or winter, and after a number had been overcome and killed by gas, the following plan was adopted:

A shaft was picked down through the frozen muck to the gravel as before, and then a big fire was built on the surface at the top of the shaft in which a number of large rocks were heated. These were then thrown to the bottom of the shaft and covered with moss or brush. Next day the moss, brush and rocks, now cool, were hoisted to the surface with a windlass

Front street Dawson, on bank of Yukon river

and as much of the gravel as the hot rocks had thawed; then the rocks were again heated and thrown down the shaft, and the process was repeated until the bed-rock was reached.

Such were the methods of mining practised in the Klondike in 1897 and 1898, and it must be remembered that such are still the only methods available in remote districts to which machinery cannot be transported.

Thawing by Steam.—But the men soon began to recognize that while shallow ground might be worked by hand with a possibility of profit, deep ground, which would need to be undermined, must be thawed in some other way than by wood fires or hot rocks, if it was to be mined quickly and cheaply, and that most of the mining in the country must be done in deep ground. Many plans were suggested and tried for thawing ground, but it would appear that John McGillivray, a mining engineer from California, was the first to adopt the method which has since come into general use. In the winter or spring of 1899 he took a small steam boiler to a mining claim on Sulphur creek, and then began thawing the frozen gravel by steam, the method adopted being about as follows:

A shaft was picked down through the muck, and near it the boiler was set up on the surface. A small iron pipe was connected to the boiler and run down to the bottom of the shaft, where it was connected by an india rubber hose to a loose piece of one-half inch pipe pinched in at the point. Steam was raised in the boiler to a pressure of from twenty to thirty pounds to the square inch, a valve which had been set in the pipe was opened, and steam was let into it. The loose pipe, known as the "point," was then gradually pushed or driven into the gravel to its full extent, the steam issuing from the aperture at its tip thawing the gravel

in front of it, and it was allowed to remain for several hours, during all which time steam was supplied through it from the boiler to the gravel in front of and around it. In this way the gravel was thawed to a much greater depth than a wood fire would penetrate, and by increasing the size of the boiler and the number of points, a long section of the wall of a drift could be readily thawed at one time.

McGillivray's plant was undoubtedly inefficient, as the pipes, rubber hose, and especially the points were too weak for the work required of them, but nevertheless he had discovered the correct way of thawing

Street at south end of Dawson City

frozen ground by steam. From his little boiler and plant has developed the efficient steam-thawing plant in use at the present time in so many of the placer mines of the Yukon territory and Alaska. The plant consists of a boiler of twenty-five to fifty horse-power, not too heavy so as to be immovable under ordinary conditions; iron piping to conduct the steam to the place where it is to be used, steam hose of the best quality; and points, five feet or more in length, made of double thickness hydraulic steel pipe, each with a tip of very hard manganese steel, in the end of which is a hole a quarter of an inch in diameter; and a heavy steel head, into the side of which is welded a hollow nipple over which the steam hose may be clamped. The points are driven into the gravel, or loose bed-rock, with a heavy mallet, while at the same time the steam from the boiler, which is kept at a pressure of from eighty to one hundred pounds, is turned into them. As a rule they can be driven to their full length in a few minutes, for the steam thaws the gravel in front of them very quickly, while at the same time it prevents any pebbles or chips of rock from becoming wedged in the hole in the tip.

One great advantage of this steam-thawing plant was apparent from the first, namely, it made underground mining of frozen ground possible in summer. It not

Steamer on Yukon river, near Dawson

only meant that mining could be prosecuted throughout the whole twelve months of the year, it also meant that the dirt mined in summer need not be piled up in dumps, from which it would again need to be thawed and afterwards shoveled into sluice-boxes, but that it could be discharged into sluices as soon as it was extracted, and that the gold could be immediately separated from it.

There are many occasions on which the steam-thawer is now used, other than for thawing the gold-bearing gravel in the drifts underground. A shaft may be sunk with it, either by driving short points vertically into the frozen ground, and digging out the thawed dirt from time to time, or by driving a long point, from twenty to thirty feet long as occasion may require, vertically down through the muck and gravel to bed-rock, steaming it for a day or two, and then

Dawson City, at foot of Moosehide Mt.

digging out the whole of the thawed dirt at once, the [illegible] Dumps of pay-dirt extracted during the winter, and again frozen hard, may be quickly thawed by the steam thawer in order to [illegible] the gold from the gravel. In the operations the

uncovered gravel may be thawed in order to hasten the mining work in the early summer, or to prolong it in the autumn.

Pulsometers.—In some mines pulsometers were used underground to thaw the pay-dirt in the drifts, the water being pumped over and over again against the face of the gravel, breaking it down and washing it and the gold contained in it back for a short distance, this latter process being assisted by a man with a rake. In this process the water is heated by the condensation and discharge into it of the steam used in the pulsometer. In other mines a similar result was attained by pumping water with a small duplex pump from the sump against the face of the gravel, the water being first slightly heated by steam direct from the steam-pipe.

Steam Hoists.—At first the steam generated in the boiler was used entirely for thawing the frozen ground and the pay-dirt, as before, was shoveled into small buckets, dragged on skids to the shaft, hoisted with a hand-windlass, and then emptied by hand on the dump or into the sluice-box. This arrangement necessitated the keeping of one windlass man on the surface for each miner underground, and so, with firemen, wood-haulers, etc., it meant that altogether too small a proportion of the crew were actually engaged in getting pay-dirt. Small steam-hoists were therefore introduced, which would hoist as much as two or three men could shovel up and bring to them; but this did not materially lessen the cost of operations, for more wood as fuel was needed to generate steam to supply the hoisting engine, a man was needed at the engine and another at the top of the shaft, and thus the amount of unproductive labor demanded was but slightly reduced. The limit of size of the bucket raised by the hoist was determined by the size and weight which the man at the mouth of the shaft could handle and empty.

Dawson Carrier.—The greatest improvement in the mechanical moving of the pay-dirt was accomplished by the invention of the self-dumping cable-tram, or

Dumps of pay-dirt on Gold Run creek, showing Dawson self-dumping carrier

"Dawson carrier," carrying a bucket with a capacity of from nine to eleven cubic feet. By its means one man at the hoist can raise from the shaft, and either pile up in a conical dump or empty into a sluice-box, as much dirt as eight or ten miners underground can pick down and wheel to the roisting bucket. By its assistance pay-dirt in solidly frozen ground can be mined from tunnels and drifts, and hoisted and sluiced for about three dollars a cubic yard, with wages at six dollars a day, and dry spruce wood for fuel at ten dollars a cord. Since, with this plant and in a properly conducted mine, about two-thirds of the men employed are working underground with pick and shovel, it is not likely that this cost can be greatly reduced while wages remain at their present rate.

Improvements Above Ground.—The modifications of the methods of open cutting and ground-sluicing adopted in 1897 and 1898 have been usually on well-known engineering lines, and have not exhibited the same originality as has been shown in the improvements of the underground mining methods. The general practice is still to pick the muck down into the stream and then to allow the water to carry it off. After the muck has been removed and the frost has been drawn out of the gravel by the warm air of one or two summers, the barren upper gravels are usually removed, either with shovels and wheelbarrows, horse-scrapers, or steam-scrapers, and piled into waste dumps.

Sluice from Tyrrell's hydraulic mine on the Bonanza creek benches

After the barren gravel has been removed the pay-dirt is either shoveled into sluice-boxes set in the bottom of the cut, the water used being afterwards raised by a centrifugal pump to the general surface level; or the sluice-boxes are set over the cut, and the pay-dirt is shoveled, usually in two stages, into them; or the sluice-boxes are set above and to one side of the cut, and the pay-dirt is wheeled to a bucket which is hoisted in some way, preferably by a "Dawson carrier," and emptied into the sluice-boxes.

In mining the gravel on the terraces or benches, high above the level of the streams, the early miners were usually at the disadvantage of having no water immediately available, so that the pan and rocker were the only washing plants that could be used, and water for these had often to be carried up a height of several hundred feet in pails. The owner of one of the richer of these claims might have from six to ten men with rockers working for him, but on account of the great expense of such work no attempt was made to mine ground that would yield gold of less value than fifteen or twenty dollars a cubic yard.

After the narrow belts of rich and shallow ground along the edges of the benches or terraces had thus been shoveled off, and the gold extracted from them in rockers, the miners began to run adits into the hills, along the bottom of the gravel on top of bed-rock, and to bring out the pay-dirt to the "run" to be washed in

rockers. But this process of mining and hand-washing proved entirely too slow and expensive. Consequently the pay-dirt was mined and brought out to the mouths of the adits, where it was piled up for a time, and was then either run down the hill in a chute to a sluice set near the creek, and supplied with water from it; or, if it was impossible to dump tailings on the creek claim, a pump was installed and water was pumped up the hill and allowed to run down again through the sluice-boxes, being often used two or three times over by different parties in its descent. At a later date

A winter scene in valley of Klondike river, near Dawson

ditches, sometimes several miles in length, were dug to bring water from tributary streams at a sufficiently high elevation to enable the miners to wash these dumps of pay-dirt.

The methods of mining adopted on these terraces, or so-called "hillside" claims, were for the most part very similar in character to those used in underground mining in the creek claims. An adit was run along the top of the bed-rock to the rear boundary of the claim, or as far as pay-gravel could be found, and drifts were driven at regular intervals at right angles to it. The intermediate pillars were then taken out, a certain amount of timbering being usually necessary to support the roof while the pay-gravel from these pillars was being removed. In most of these mines the ground was frozen and had to be thawed with steam-points; but in some cases, generally where the overburden of barren gravel was more than two hundred feet thick, the ground was not frozen, and in such places mining could progress much more steadily and regularly. In some instances, however, the claim which the miner desired to work did not extend to the rim, so that it could not be worked from an adit, and in that case it was necessary to sink a shaft and mine in the same manner as in the bottom of the valley, the chief difference being that the shaft was usually deeper, and the expense of obtaining water for washing the gravel was very much greater. In other instances, after the value of the gravel in these bench deposits had been proved by tunnelling, water was pumped up from the creek in the bottom of the adjoining valley to heights of from fifty to one hundred feet above the level of this gravel and was then delivered against it through hydraulic giants, thus washing it off the rocky bench on which it lay, the water with its load of gravel being directed in its flow through cuts in the bedrock, and then through sluice-boxes in which the gold was caught before it was allowed to fall into the valley below.

The enormous expense of installing such a pumping plant in a region so remote and difficult of access, and the great cost of fuel after the plant had been installed, soon proved that such a method of mining was too expensive, even for the very rich ground that was being operated upon; but it also proved that hydraulic methods of mining were quite feasible in the Klondike, and that the frost in the ground was no bar to the employment of such methods.

The gold-washing and separating apparatus in use in the Klondike has remained practically unchanged throughout the life of the camp. Leaving the "rocker" out of consideration, it consists of a string of sluice-boxes, each twelve feet long, twelve or fourteen inches wide at the upper end and two inches narrower at the lower end. These boxes are placed so that the small end of one box just slips into the large end of the one below it, and are supported and braced so as to have a grade of from six to nine inches to each box. In the middle of the string there is usually one box much larger than the others, called a "dump-box," in which a man stands with a heavy "sluice-fork" to stir the gravel and throw out any rocks too large to run easily through the smaller boxes. In the bottom of all these boxes small rounded poles, called "riffles," are laid lengthwise and are fastened together by short transverse strips every six feet. Water varying in quantity from two hundred and fifty to seven hundred gallons a minute is turned into and allowed to flow through these sluice-boxes, and as the pay-dirt is shoveled or

Brushing gold from black sand, Claim 44, Hunker creek

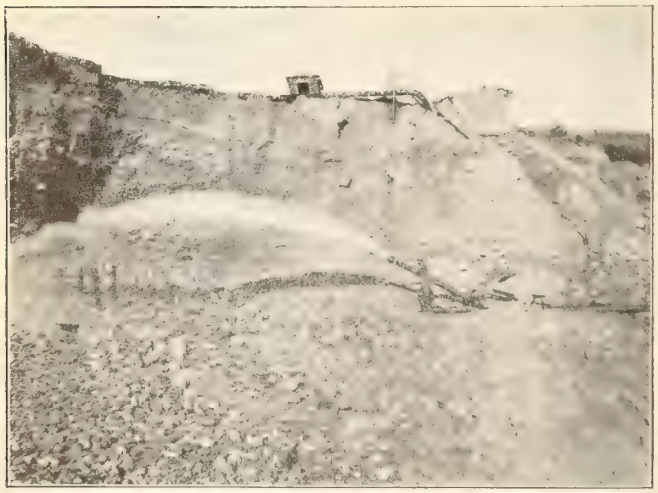
emptied into them, it is carried along by the water, and the gold settles to the bottom and is caught between the riffles, while the gravel and sand is discharged from the lowest box at the tail of the sluice. The riffles are raised and taken out from time to time, and while a small quantity of water is allowed to flow through the boxes, the gold is carefully separated with wooden paddles and brushes from the gravel caught with it in the riffles.

Dredging — In 1903 a dredge was installed on the Klondike river on the lower part of Hunker creek, a few miles below the mouth of the Teslin, and was operated for a year or two without success, apparently because there was not sufficient depth of gravel to enable the dredge to do effective work. The gravel did not descend to any considerable depth into the gravel. In the following year it was brought down to

Bonanza creek and set up on Claim 45 below Discovery, where it operated for a short time and whence it was removed to the Discovery group of claims, where it finally operated with great success. This was a ladder and bucket dredge with bucket stacker, and though too small for the work, it proved to be the correct type. Dredges of such type, if properly managed, save very nearly all the gold at a very much lower cost than the material can be handled in any other way. However, they labor under the disadvantage of not being able to work in frozen ground. So far this difficulty has been overcome by thawing the ground in front of the dredge with a steam-thawer, which, however, adds greatly to the cost.

Since this dredge was installed many others have been added, so that during the summer of 1911 there were working on the river bottoms in the Klondike in all about seventeen dredges, most of which were digging in frozen ground, though in a few cases, on account of local conditions, the ground proved not to be frozen. The absence of large boulders makes the gravel very easy to handle with these dredges, after it has been thawed or when it is free from frost, and the dredging industry should prove one of the most profitable of the mining industries of the country for many years to come.

Hydraulic mining was begun early in the history of the camp, but with comparatively little regard to the expense of obtaining the large quantity of water that is necessary for this method of operation. The first hydraulic plant was started on Hunker creek by George Johanssen, who spent a large sum of money in buying a number of hill claims. He operated by pumping up water from the creek at an enormous cost. Other similar operations were then begun on Bonanza creek, but, in most if not in all cases, without financial success, even though a very large quantity of gold might be recovered. Gradually all these pumping plants were



One of earliest attempts at hydraulic mining on Bonanza creek

abandoned, and water was taken from the small creeks and tributaries of the larger streams and was used at a low head against the gravels, cutting them down, the gold being recovered from them in sluices.

The Great Ditch.—About 1906 a large impounding dam was built near the head of Bonanza creek, forming a reservoir with a capacity of three hundred and fifty million gallons. The water from this reservoir is taken through ditches, flumes, and pipes, with a total length of nine miles, and is used on the hill claims in the valley of Bonanza creek, near the mouth of Eldorado creek. In the same year the Yukon Gold Co. also undertook to bring water to Bonanza and Hunker creeks from the upper waters to the Twelvemile river, which flows into the Yukon eighteen miles below Dawson, and has its source in the Rocky mountains to the northeast. This great artificial waterway has now been completed to carry 125 second feet, or five thousand miner's inches of water, at a cost of more than $3,000,000. It has a total length of 70 miles, made up as follows: Ditch, 38 miles long and 9-20 feet wide, with

J. B. Tyrrell's camp, Claim 39. Hunker creek

3½ feet depth of water; flume, 19.6 miles long, 6 feet wide and 4 feet deep; pipe, wooden stave, steel bound, 8.8 miles in total length and 42-54 inches in diameter; pipe, steel, 3.8 miles in total length, 42-49 inches in diameter, the steel varying from ¼ to 11-16 inch in thickness.

The water enters the ditch at an elevation of 3,320 feet above the sea, and is delivered from the pipe on the south side of the Klondike valley at an elevation of 2,240 feet above the sea, or 1,040 feet above the level of the Yukon river at Dawson. The water from this great ditch is being used to break down and wash the gold from the extensive deposits of white terrace gravel that occur along the Klondike river and its tributaries.

Chief Producing Creeks.—In the Klondike the chief producing creeks have been Bonanza, Eldorado, Hunker, Bear, and Dominion with its tributaries Gold Run, Sulphur and Quartz.

In 1906 R. G. McConnell, of the Geological Survey of Canada, made a careful estimate of the past production and future possibilities of the gold-bearing gravels and the following figures are taken from his report to the Canadian Government.

Speaking of the gravels of the Third Cycle, or Creek gravels, he says: "The Eldorado paystreak has a length of about four miles, and its production up to the present is estimated at $25,000,000, or about $1,200 a running foot for the bottom of the valley." But some of the claims 500 feet in length yielded more than a million dollars, or more than $2,000 to the running foot of valley bottom. "Upper Bonanza creek, the portion above Eldorado forks, proved rich up to Victoria gulch, a distance of about four miles. The paystreak in places rivalled that on Eldorado creek in richness, but the general average grade was considerably lower. The past production is estimated at $15,000,000," or more than $700 to the running foot. "Lower Bonanza creek has a length of about ten miles, and with the tributary gulches has produced about $11,000,000. Klondike river flat has produced $1,000,000. Bear creek has produced $1,000,000. Hunker creek

with its tributaries has produced $14,000,000. Dominion, with its tributaries Gold Run, Sulphur and Quartz, has produced $24,250,000.

Some of the gravel on the creeks was phenomenally rich. One pan of gravel weighing about fifteen pounds, taken from undisturbed deposits on Bonanza, and washed in the presence of the writer, yielded forty and a quarter ounces of gold, the largest nugget in the pan weighing an ounce and a half.

In speaking of the terrace gravels of the Second Cycle of erosion, McConnell says: "The gravel in the paystreak of all these Upper Bonanza (and Eldorado) hills proved rich everywhere, and in places the values returned appeared almost fabulous. Whole claims are reported to have averaged from $60 to $100 per square yard of bed-rock. Portions of French, Gold, Chechaco and Magnet hills were particularly rich, and yields of a dollar a pan, or $150 per cubic yard for the lower four or five feet of gravel, are stated to have been obtained from small areas of these hills." A number of cases of much higher values than the above have been credibly reported. On both French and Gold Hills men have taken out with a rocker as much as five thousand dollars a day, and as the men probably would not handle more than two and a half cubic yards apiece, the yield would be about two thousand dollars a cubic yard. The yield of these gravels from Boulder hill upwards is placed at $24,000,000. The terrace gravels on Bonanza Creek below Boulder hill yielded $750,000. The similar gravels on the hills of Hunker creek produced $2,500,000. At the same time (1906) McConnell placed the estimated future output of all the Klondike gravels at about $63,000,000, since which time, up to January 1st, 1914, the country has produced a total of $31,311,012.

Gold Production of Yukon.—Up to January 1st, 1914, gold mining in the Yukon has produced gold of the following quantities and values:

Calendar Year.	Oz. (fine).	Value.
1885-1886	4,837	$100,000
1887	3,386	70,000
1888	1,935	40,000
1889	8,466	175,000
1890	8,466	175,000
1891	1,935	40,000
1892	4,233	87,500
1893	8,514	176,000
1894	6,047	125,000
1895	12,094	250,000
1896	14,513	300,000
1897	120,937	2,500,000
1898	483,750	10,000,000
1899	774,000	16,000,000
1900	1,077,553	22,275,000
1901	870,750	18,000,000
1902	701,437	14,500,000
1903	592,594	12,250,000
1904	507,938	10,500,000
1905	381,001	7,876,000
1906	270,900	5,600,000
1907	152,381	3,150,000
1908	174,450	3,600,000
1909	191,565	3,960,000
1910	221,091	4,570,362
1911	224,197	4,634,574
1912	268,447	5,549,296
1913	282,838	5,846,780
		$162,359,512

These are the official returns as given by the Geological Survey and the Bureau of Mines of Canada and computed from the returns of the American Mint and the banks and Government offices in the Yukon, with reasonable allowance for gold that could not be accounted for through these channels. Some people are inclined to add largely to these figures for gold lost and unaccounted for, but a residence of seven years among the miners of the Klondike convinces the present writer that such enlarged figures are mostly gross exaggerations and that the official estimates are quite high enough to account for every ounce of gold that has come out of the country.

Silver.—The production of silver has been confined, with the exception of a very small amount taken from the prospects in the Southern Yukon, to the quantity occurring with the gold and extracted from it when it is reduced to bullion.

Copper.—Copper occurs in the southern portion of the Yukon territory in a belt extending from near the

One of the oldest homes in Dawson, occupied by J. B. Tyrrell

town of Whitehorse westward to the international boundary line. In the vicinity of Whitehorse the ore is in the form of sulphides and is found in more or less extensive contact veins along the contact of limestone and acid intrusives. A large number of claims have been staked, and from these some ore has been shipped southward to the smelter on Vancouver island, but the high cost of transportation and the consequent excessive cost of labor and supplies has militated very strongly against the successful operation of these properties.

Near the international boundary line at the head waters of the White river and its tributaries native copper is found in some abundance in the gravel along the stream, and in time the recovery of this copper may prove to be a profitable and successful industry.

Tin.—As yet tin has not been found in commercial quantities in the district, but grounded particles of cassiterite or stream tin were constantly found in the sluice-boxes in the Klondike with the gold, and it is possible that in some places it may be discovered in paying quantities.

Tungsten.—Scheelite, one of the ores of tungsten, was found in some abundance associated with gold in the sluice-boxes on Dancing creek, near the head waters of the Stewart river, but so far it has not been discovered anywhere in commercial quantities.

Antimony.—Some veins rich in antimony ore have been discovered in the mountains on the Wheaton river southwest of Whitehorse, but up to the present they have not been worked.

Coal.—In rocks of Lower Cretaceous age, at about the same geological horizon as the Kootenae rocks in which coal is so abundant in the Rocky mountains in Alberta, coal is found at a number of places in the Yukon territory, varying in character from anthracite in the Wheaton district to lignite at many places on the Lewes and Yukon rivers. In the reports of the Geological Survey the area known to be underlain by coal is given at four hundred square miles, and the estimated quantity available is given as follows:

	Tons.
Anthracite	32,000,000
Bituminous coal, often making excellent coke	32,000,000
Lignite	850,000,000

But further examination will doubtless add largely to these figures.

Some coal from the Tantalus mine on the Lewes river has been used to supply the steamers on the Yukon river, and some from the mines on Coal creek, north of Dawson, is being supplied to the Dawson market, but the quantity used in the territory is not large. However, as industries of various kinds increase in number, this great reserve of fuel and potential energy may prove to be one of the greatest natural assets of the country.

Movement of People into the Yukon Territory between Years 1897 and 1900 inclusive.

Prepared by Col. A. B. Perry, Supt. R.N.W.M. Police.

	Men, Women and Children.	Boats, Scows, etc.
1897	700	150
1898	28,000	7,124
1899	5,434	880
1900	8,452	973
Total	42,586	9,127

HOIST RECORDERS.

Within the past few years recorders for almost every purpose have come on the market, the latest of which has been brought to our attention being the Johnson Hoist Recorder, made at Ishpeming, Mich. This machine is for use at shaft mines of every description.

These recorders will furnish a complete record of the movement of the skip for each shift of twelve hours or less, showing the time taken in moving same from one point to another, showing all delays, the length of same and just where these delays occurred; also the number of loads hoisted from each level and the total amount hoisted daily. This record will also furnish valuable evidence in the case of accidents connected with the skip, delays and mistakes which occur from time to time, and which record will eliminate conflicting reports between men underground and engineer in charge of hoist, and a record which may be filed and referred to at any time.

These machines are neatly and substantially constructed, case being of metal, nickel plated with sides and doors of bevel plate glass. They are easily attached to any type of hoist and will take care of a depth up to ten thousand feet.

BASIC PRINCIPLES OF MINING COST*

By James R. Finlay.

The total cost of operating a mine can be divided into at least three independent items, namely: (1) labor, (2) power, (3) supplies. It is important to make this classification for two reasons: first, because the three items do not enter in the same proportions into the cost of operation at all mines; and second, because the variation in the cost for one item, from place to place, may not be in the same ratio as for another of the three items.

In general, the cost of mining in a given locality will vary with the expense and facilities for obtaining labor, power and supplies. Of all the mining regions in North America, I believe that the most favorably situated in found in Western Pennsylvania. Between Pittsburg and Lake Erie is a vast fertile country, capable of supporting a large population; food is abundant, climate excellent, and sociologic conditions are favorable. Hence labor is cheap and, what is of even greater advantage, can be carefully selected with a view to fitness. For power, the immense bituminous coal fields, and the areas yielding both oil and gas are close at hand. Finally, the district is surrounded and dotted with great manufacturing centres, whence mining supplies are available in great variety and at small expense of transportation.

When we seek to compare mining costs in so favorably situated a district with those prevailing in another part of the country, for example, Alaska, or the desert parts of Nevada, strict allowance must be made for the changed environment. In both the localities just mentioned, and in many others as well, labor must be imported, and it is not so easy to exercise discrimination in its selection. Furthermore, in a remote locality, food is often poor and usually expensive, and many of the ordinary comforts of civilized life, sometimes even the decencies, are wanting. These hardships must naturally be compensated, in the form of higher wages. The cost of power is likewise generally higher, because of the expense for transportation of fuel. In some favored localities, the supply of wood may suffice for a while, and in others hydro-electric power may be available, but the great majority of mines rely upon coal, and in many cases it will be found that the cost of transport exceeds that of mining the coal. Thus, coal which sells at Pittsburg for, say, $1 per ton will cost $2.50 in the Lake Superior district, $4.50 in the Rocky mountains, and as much as $7 or above in more remote districts. The same holds true of supplies, to the original price of which must be added cost of transportation by boat, rail, wagon or mule-back. Since steel and dynamite, the two most used materials, are relatively high priced, the added cost due to transportation is proportionately less than in the case of coal.

As a concrete example of the preceding remarks, let us compare a mine in southeast Missouri, with one in Nevada, in both of which districts I have recently been so fortunate as to gain first-hand experience; in both cases we shall estimate that the output is at the rate of 4 tons per man per day. In southeast Missouri, labor (at $2.60 per day) costs 65c. per ton of ore mined and milled; power (coal selling at $2.25 per ton) costs 25c per ton of ore; and supplies cost 15c. per ton of ore; total $1.05 per ton. Profit on this ore would then be about $1 per ton, out of which to deduct various general and interest charges. At a mine of the same character in Nevada labor (at $4.00 per day) would cost $1.00; power (coal at $6.75 per ton), 75c.; supplies (estimated at 20 per cent. higher than in Missouri) 18c.; total $1.93

*A lecture before a class of mining engineering students in the Columbia School of Mines, May 4, 1915, and published in School of Mines Quarterly, No. 3, 1915.

per ton of ore, or $0.88 more than in Missouri. If the ore had the same market value, the profit would be only $0.12 as against $1.00, and this difference would very probably be the deciding factor in determining whether or not to begin operations in the more remote district. In short, the extreme variability of operating conditions at different mines, and in different districts, must never be overlooked.

It has been said that mining engineers do not know how to figure costs, as a contractor would figure them. This is not exactly true, because all successful engineers really do know how to do it, and the wider their knowledge of operating factors, the less liable they are to make mistakes. As a rule, careless or ignorant computations result in underestimates. An excellent practice is for an engineer to put himself in the position of a contractor, personally responsible for a loss; cost estimates then cease to be academic questions.

The most fertile source of mistake in cost estimates is to assume that the data relating to a short period, possibly during a stage of most advantageous operation, are a true average over the whole life of an undertaking. It should be remembered that the cost of an enterprise includes everything that has to be done from start to finish. To illustrate, suppose a shaft has to be sunk in New York City. If a practical miner were asked how much it would cost, he would first inquire how hard the rock is, and would then figure the cost merely as a job of rock breaking, at so many feet per shift. A contractor, on the other hand, would include in his estimate the necessity for installing hoists, compressors, shops and headgear, entailing maintenance, depreciation and interest on the cost of equipment during the whole period of operation.

In comparing one mine with another, the physical characters of the ore deposits are no less important than their geographical situations, a feature of the problem which is sometimes carelessly overlooked by those who ought to know better, and often purposely disguised by those who have some nefarious purpose in view. How often have we heard promoters calmly assert that a gold-bearing vein in Georgia, for example, could be mined at the same cost per ton as at the Homestake or the Alaska Treadwell?

The importance of careful comparison of geologic conditions was forcibly impressed upon me about three years ago when I had occasion to examine a silver mine in New Mexico at which the cost of mining and milling was $8 per ton. The mine was controlled by residents of the Lake Superior district, who, reasoning from their immediate experience, thought that the cost ought to be reduced to $3 per ton, and wished to be informed why not. The reason, of course, was that a silver lode in New Mexico is not like a bed of copper rock or a basin of hematite in the Lake Superior region, and cannot be mined in the same way. Actually, the Camp Bird mine, of Colorado, offers a much greater complexity, in width of vein, character of mineralization, and occurrence of ore shoots, the latter constituting only 25 to 30 per cent. of the whole vein and necessitating a relatively great amount of exploration and development. The cost at Camp Bird is from $7 to $8 per ton. My Lake Superior friends failed to be impressed by my reasoning, and proceeded to capitalize and equip their mine on the assumption of $3 costs; they are now sorry they did so.

While a careful reasoning from analogy may lead to disastrous failure, as in the case just noted, on the other hand, if geologic conditions and working environment at a new locality be reasonably similar to those at an older and established mine, the first offers a quick and serviceable means of estimating the probable working cost at the mine about to be developed. In fact, a simple comparison, provided that all conditions are closely parallel, or provided that allowance is made for divergent conditions, is much more useful, and accurate, than any amount of independent figuring.

Hamilton Smith's Rule.—In this connection, it is often possible to make use of certain formulas and standards of comparison which are not so well known as they deserve to be. Hamilton Smith, a distinguished engineer about 30 years ago, suggested the advantage of comparing mines on the basis of yield per unit of stoping area, and gave as his opinion that, with gold ore of good quality, no mine would be profitable which yielded less than $3 per square foot of stoping area, equivalent to $130,000 per acre. Applying this formula recently to a fairly profitable gold mine in Nevada, having a vein 1 ft. thick, of ore averaging $40 per ton, I was interested to observe, allowing 13 cu. ft. per ton, that the yield of that mine was almost exactly $3 per sq. ft. of stoping area. Actual stoping width was about 4 ft. and profits were about 20 per cent. of the gross yield.

Smith's factor is important to bear in mind, regardless of other estimates of cost obtained by calculation, comparison, or otherwise, especially for checking over estimates of net profits. A mine alleged to yield net profits of 75 per cent. of the gross output should be approached cautiously, because such mines are very rare. The Goldfield Consolidated, for example, for considerable periods yields at the rate of $20 per square ft. of the whole area of vein explored, not merely shoot or stoped area; yet the net profits of this mine for the past five years have averaged only 58 per cent. of the gross yield, under particularly competent management.

Cost Per Ton.—Some people are inclined to attach too much importance to "cost per ton," as though this unit possessed some sacred functions. It may often happen that some other unit, as Smith's yield per unit of stoping area, is more serviceable and relevant. Cost per ton is merely the value of the work that has been done on that ton, and may bear a very indefinite relation to the profitableness of the operation. As an extreme case, 1 ton of gold, worth $600,000, might be mined for $450,000, or 75 per cent. of its value, yielding a profit of $150,000. A ton of silver, worth $15,000, is mined at Cobalt for $6,000, or at $600 per ton of ore, assuming it to contain 10 per cent. silver; yet, rightly considered, this should not be called expensive mining. At Grass Valley, Cal., it costs about $5 to mine and mill 1 ton of ore; at the Michigan copper mines it costs only $1.25; yet applying Smith's unit, we find that the cost per acre of stoping area is nearly alike in these two places, namely $100,000 at Grass Valley and $70,000 to $120,000 in the copper country. In southeast Missouri, the cost is almost exactly $100,000 per acre for mining and milling. We thus see that **the really important factor is not how many tons are mined, but how much area must be excavated.**

Finally, before making comparisons of cost, it is important to note the relative difficulties arising from different positions of an orebody; it makes a great difference whether a deposit is horizontal, vertical or inclined. A horizontal deposit is always the cheapest to mine because one shaft is only one level, one shaft, one pump station. A vertical deposit requires many levels and separate pumps, requiring a shaft station, and sometimes an independent pump station. Inclined deposits, if not steep enough for [illegible] involve all the disadvantages of a vertical, with the added expense of hoisting [illegible]

ELECTRO-PLATING WITH COBALT*

By H. T. Kalmus, C. H. Harper and W. L. Savell.

Results obtained in electroplating with cobalt solutions prepared at the laboratory at Queen's University were thought by the authors to be so unusual and of sufficient importance to warrant verification and further development under standard commercial conditions. We therefore, arranged with the Russell Motor Car Co., of Toronto, Ontario, and particularly with Mr. W. S. Barrows, foreman electroplater, with the same company, to have a plating tank operated under standard commercial conditions at their plant.

Salts identical with those used in this laboratory were sent by the authors to Mr. Barrows, with instructions for making up two solutions, identical with those used by us.

Mr. Barrows has had some twenty years of experience with all sorts of electro-plating work, to which he has particularly devoted himself. He has considered these two solutions entirely from the point of view of commercial practicability and value.

The authors take great pleasure in expressing their thanks to the Russell Motor Car Company, and to Mr. W. S. Barrows, for their collaboration, and particularly to Mr. Barrows for the careful, vigorous and painstaking manner in which he has subjected the solutions and plates to the various tests that were required, to establish their commercial importance and value.

Cobalt anodes were cast at this laboratory of the size required by Mr. Barrows for his tank, and sent him for use in these experiments. They analysed as follows:

Co.	98.75
Ni.	none
Fe.	1.35
As.	none
P.	0.0067
S.	0.052
C.	0.061

The anodes used in a bath had a surface of approximately 1 square foot area.

Mr. Barrows, in collaboration with the authors, tested solution I B (cobalt ammonium sulphate) for plating purposes, during the months of August and September, 1914. The plating was accomplished under standard commercial conditions on copper, brass, iron, steel, tin, German silver, lead and Britannia metal. Various articles, such as brass castings, sheet brass, steel stampings, skates, automobile hubs, etc., etc., articles of very different shapes and sizes, were plated under exactly the same general conditions as for nickel plating practice at the Russell Motor Car. Co.

The tests were made in a still solution, that is without agitation of any kind, and the resulting plates were subjected to the most severe practical tests. This work was regarded by Mr. Barrows purely from the commercial viewpoint, and with this in mind, he particularly tested and studied the following points—the color of plate, the uniformity and freedom from defects of the plates, the allowable speed of plating without pitting or burning, or the maximum allowable current density, the solubility of the anodes, the required voltage, the "throwing" properties of the bath, that is, its ability to cover the deeper parts of the object in a satisfactory manner, the solubility of the salts, the hardness of the plates, the ease of "coloring" the plate on a buff, the efficiency of the plating solution, the time required for ageing of the bath, the adhesiveness of the plate to the cathode under bending and hammering tests, the general cleanliness of the bath, the corrosion of the plate, besides many other special features.

In a letter to one of the authors, dated November 2nd, 1914, Mr. Barrows gives a very complete report of his commercial tests of solution I B. This letter follows in full as received, and serves admirably to cover this portion of the work.

628 Dovercourt Rd., Toronto, Nov. 2nd, 1914.

Dr. Herbert T. Kalmus,
Queen's University, Kingston, Ont.

Dear Sir,—After preparing a cobalt plating solution according to your formula for bath I B, and having used this bath daily during the past eight weeks, plating a great variety of copper, brass, iron, steel, tin, German silver, lead and Britannia metal articles of different shapes and sizes under exactly the same conditions as met with in general nickel plating at the factory of the Russell Motor Car Co., West Toronto, and after regarding the characteristics of this particular solution absolutely from a commercial viewpoint, I can heartily confirm any statement you have made to me regarding this remarkable solution. This bath was equipped with cobalt anodes, 98.75 per cent. cobalt, which were sent to me from your laboratory.

The runs made have varied from five minutes to 24 hours, and in each case the bath has proved wonderfully efficient.

The cobalt plates obtained were smooth, white and fine grained, very adherent and uniform. In fact the surfaces of these deposits after several hours' run were so very smooth and uniform, that a 4-inch cotton buff colored them to a mirror finish quite easily. We use 14-inch and 16-inch buffs to color 3-hour deposits of nickel.

To test the hardness of the cobalt as compared with nickel, with reference to either buffing or polishing with emery, we plated strips of brass, one-half the surface with cobalt and one-half with nickel, always giving the nickeled portion the thickest plate. Then buffing or polishing across the two deposits we found invariably that the nickel was removed from the brass before the cobalt, and in some cases in one-half the time.

Though so hard and firm, these plates color beautifully with little effort, and require the use of much less buffing composition than comparatively thin plates of nickel. Automobile parts of irregular shape were plated from 10 to 20 minutes, and finished on a 6-inch buff operated at 3,000 r.p.m. without the slightest evidence of a defect in the plating. To accomplish this with our fastest nickel baths would require at least 60 minutes of plating.

As a protective coating for iron or steel surfaces I am convinced that a comparatively thin plate of cobalt will prove equally as effective as a thick plate of nickel from an ordinary double sulphate nickel bath, and the time and power required for the production of such plates is decidedly in favor of the cobalt.

The deposits are also very adherent, no difficulty having been experienced in this respect, although tests

*Extracts from a report by H. T. Kalmus, C. H. Harper and W. L. Savell, on researches conducted at Queen's University, Kingston, for the Mines Branch of the Department of Mines, Ottawa.

were made repeatedly by bending, hammering and burnishing.

One of the weak points of several so-called rapid nickel plating solutions which we have tried commercially, is their poor "throwing" powers, i.e., they do not deposit the nickel readily in the indentations or cavities of the cathode. The cobalt solution I B meets this requirement in a most efficient manner, the deposits on the distant portions of the cathode withstand the tests imposed in every case.

Another most important feature of this solution, which should commend itself to every practical plater and manufacturer of plated wares, is the extremely high current density at which this solution may be employed without danger of pitting the plated surface. I have plated with this cobalt solution I B satisfactorily and under commercial conditions, at a current density of 42 amperes per square foot. This is four and one-fifth times the speed of our fastest commercial nickel solutions.

As a further test we plated steel tubes of 1-inch diameter for two hours, with a current density of 27 amps. per square foot, and then drew the tubes down to ⅝-inch diameter without injuring the deposit. Though extremely hard, the ductility of the deposited metal proved remarkable.

All of our tests have been made in a still solution, without agitation of any kind, and the plates were subjected to the most severe treatment considered practical for high grade metallic coatings on the various metals heretofore mentioned.

We are also of the opinion that the anodes in the cobalt bath I B will remain free from coatings, such as characterize average anodes used in nickel baths, and that the cost of maintenance will be practically nothing compared to double sulphate nickel solutions.

I can assure you that my experience thus far with these cobalt solutions has been intensely interesting, and I sincerely believe that their use commercially would revolutionize the art of electroplating such wares as are now nickel plated.

The simplicity of its composition, its self-sustaining qualities, the remarkable speed of deposition, together with the several points mentioned previously, should appeal to the commercial requirements of this progressive age. I remain,

Very truly yours,

(Sgd.) WALTER S. BARROWS,
Foreman Electroplater,
Russell Motor Car Co.,
West Toronto, Ont.

After the completion of the tests on solution I B by Mr. Barrows, salts identical with those used by the authors were sent to him, with instructions for preparing solution XIII B (cobalt sulphate, salt and boric acid).

The anodes used were identical with those used for solution I B.

Tests were made of this solution in the manner and from the same point of view as those for solution I B.

In a letter to one of the authors, dated December 1st, 1914, Mr. Barrows gives a complete report of his commercial tests of solution XIII B. This letter follows in full, as received:

628 Dovercourt Rd., Toronto, Dec. 1st, 1914.

Dr. Herbert T. Kalmus,
Queen's University, Kingston, Ont.

Dear Sir,—After thoroughly testing cobalt plating bath XIII B, made according to your formula, I take pleasure in submitting the following report:

I found the bath very simple to prepare and at once began to operate the solution with high current densities. The results obtained were exceedingly gratifying. Evidently bath XIII B will require no prolonged ageing treatment, as splendid, white, hard, perfect deposits were obtained with extremely high current densities within three hours after bath was prepared.

The experiments have been varied and the tests of plates severe and deliberate, the results have invariably been such as to cause me to regard cobalt bath XIII B the greatest achievement in modern electroplating improvements.

The operation of the bath is positively fascinating, the limit of speed for commercial plating is astonishing, while the excellence of the plates produced is superior to those of nickel for many reasons.

The efficiency of the freshly prepared solution, together with the self-sustaining qualities of the bath are without a parallel in any plating solution of any kind I have ever used.

Thin embossed brass stampings were plated in bath XIII B for only one minute, then given to a buffer who did not know the bath existed and who was accustomed to buffing 1¼-hour nickel deposits on these same stampings. This man buffed the cobalt plates upon a 10-inch cotton buff wheel revolving at 3,000 r.p.m. The finish was perfect with no edges exposed. These stampings have been plated in two dozen lots for one minute and from a total of 500 stampings we have found but three stampings imperfect after buffing. Each stamping is formed to a spiral after finishing without injury to the deposit. Grey iron castings with raised designs upon the surface were plated one minute in cobalt bath XIII B, then burnished with 400 lb. of ⅛-inch steel balls for ¼ hour without the slightest injury to the cobalt coating, as was proven by a 36-hour immersion in 15 oz. of water acidulated with 1 oz. of sulphuric acid.

While attempting to reach the limit of current densities which would be practical with this bath XIII B, I have plated brass automobile trimmings with a current density of 244 amperes per square foot. These pieces were plated in lots of 6, and a total of 100 were plated, buffed and ready for stock in 1 hour's time. No unusual precaution was made for this run and the work was performed by one man. Size of piece plated 1¼ x 5 inches.

Automobile hub caps were plated three minutes in cobalt bath XIII B and buffed to a beautiful lustre of deep rich bluish tone by use of a 7-inch cotton buff revolving at 1,200 r.p.m. The deposits were ample for severe treatment usually received by such articles. Comparative tests of these deposits were made as follows. Same style castings plated in double sulphate nickel solution one hour were exposed as anodes in a solution of equal parts muriatic acid and water. Sheet lead cathodes were used and a current of 700 amperes at 10 volts passed through the bath. The nickel was removed from the castings in 20 seconds, while 45 seconds time was required to remove the cobalt plates.

The above mentioned plating tests were made with still solution, no form of agitation being employed. By

aid of mechanical agitators these current densities could be greatly exceeded with highly satisfactory results.

These cobalt plates were very hard, white and adherent and colored easily with slight effort.

Several plates were produced upon sharp steel surgical instruments, these instruments finished perfectly and owing to the hardness of the cobalt plate only a thin deposit was required to equal the best nickel deposits which we received as samples. Cobalt deposits should prove especially valuable for electroplating surgical instruments for this reason, nonadherent thick deposits being very dangerous for this class of work.

Owing to the unusual mild weather in this locality during the past month, I have not concluded test with cobalt plates on highly tempered nickel steel skate blades, but judging from appearances and various severe indoor tests we do not hesitate to report success in this direction. A three-minute deposit from bath XIII B resists corrosion equally as long as a one-hour nickel deposit, the finish is even superior to nickel, while every test employed during the process of manufacturing the nickel plated article has proven equally ineffective with cobalt plates, therefore by reason of the effectiveness of thin cobalt deposits we believe cobalt plates should prove wonderfully efficient on skates, or any keen edged tool requiring a protective metallic coating.

The runs made with bath XIII B have varied from one minute to 15½ hours, and in each case the results were remarkable. Electrotypes were reproduced 1-16 inch thick. Electro dies were faced with cobalt ⅛ inch thick, the electrotypes being graphite covered wax and lead moulds, while the dies were made on oxidized silver faced Britannia metal.

The deposits from cobalt bath XIII B were very adherent and pliable; by proper regulation of the current beautiful white, hard, tough plates may be produced quickly on any conducting surface.

The "throwing" powers of cobalt bath XIII B make possible its employment for plating deeply indented or grooved articles such as reflectors, channel bars or articles with projecting portions.

We also obtained the best plates with extremely high current densities, although plates finished with 75 amperes per square foot were of good color and easily buffed. The production of excellent plates with a current density of 150 amperes proved particularly easy and densities in this neighborhood were employed for the greater portion of our tests.

Cobalt bath XIII B will produce excellent hard, white, tough plates absolutely free from pits or blemish at a current density of 150 amperes per square foot and under ordinary commercial conditions. This is 15 times the speed of our fastest commercial nickel solution.

Furthermore, the anode tops and hooks remain free from creeping salts. The solution retains its original clean appearance and the anodes dissolve satisfactorily, no slime or coating formed, brushing or cleaning anodes therefore will be unnecessary. The anodes used with this bath were 98.75 per cent. cobalt which were sent me from your laboratory. The bath at the commencement of our tests was strongly acid to litmus, and has remained unchanged throughout our experiments. The specific gravity of the solution when freshly prepared was 1.24 and is the same to-day.

The rich deep bluish white tone of the cobalt plates upon polished brass surfaces is particularly noteworthy, this feature should assist greatly in making cobalt deposits very popular for brass fixtures, trimmings and plumbers' supplies.

My experience with cobalt bath XIII B is by no means at an end. I intend to continue its use until present supplies are exhausted and then equip a larger bath if supplies are obtainable. As a commercial proposition I am satisfied it is wonderfully efficient and economical.

Taking into account the difference in cost of cobalt as compared with nickel, I am satisfied the metal costs for plating a given quantity of work with cobalt would be considerably less than for nickel plating a like quantity.

Furthermore the use of cobalt bath XIII B equipped with automatic apparatus for conveying parts through the bath would reduce the labor cost 75 per cent., such apparatus would be practical for a greater variety of wares than is now the case with nickel.

We cannot speak too highly of cobalt bath XIII B. and confidently believe its future history will surpass the history of any electroplating bath now in general use.

In conclusion, please accept my warmest congratulations upon your successes with cobalt solutions, and heartily appreciating the opportunity of testing these solutions, I desire to sincerely thank you, kind sir, for the benefits derived therefrom.

Very truly yours,

(Sgd.) WALTER S. BARROWS.

General Conclusions from Commercial tests on Cobalt Plating Solutions.

Several cobalt solutions have been found to be suitable for electroplating with cobalt under the conditions of commercial practice. Best among these are the following:

Solution I B.

Cobalt-ammonium-sulphate. $CoSO_4.(NH_4)_2SO_4.6H_2O$. 200 grams to the litre of water, which is the equivalent of 145 grams of anhydrous cobalt-ammonium-sulphate. $CoSO_4.(NH_4)_2SO_4$, to the litre of water. Sp. gr.=1.053 at 15 degrees C.

Solution XIII B.

Cobalt sulphate $CoSO_4$....	312 grams
Sodium chloride NaCl....	19.6 "
Boric acid	nearly to saturation
Water.	1.000 c.c.

Sp. Gr.=1.25 at 15 degrees C.

Cobalt plates from these solutions, on brass, iron, steel, copper, tin, German silver, lead and Britannia metal articles, of different shapes and sizes, deposited under conditions identical with those met with in general nickel plating practice, are firm, adherent, hard and uniform. They may readily be buffed to a satisfactorily finished surface, having a beautiful lustre which, although brilliantly white, possesses a slightly bluish cast.

The electrical conductivity of these solutions is considerably higher than that of the standard commercial nickel solutions, so that other things being equal, they may be operated at a lower voltage for a given speed of plating.

Solution I B is capable of cobalt plating on the various sizes and shapes of objects met with in commercial practice at a speed at least four times that of the fastest satisfactory nickel solutions.

Solution XIII B is capable of cobalt plating on the various sizes and shapes of objects met with in commercial practice at a speed at least fifteen times as great as that of the fastest satisfactory nickel solutions.

Plates from both of these solutions on various stock pieces, satisfactorily withstood the various bending, hammering and burnishing tests to which commercial nickel work is ordinarily submitted.

These two very rapid cobalt solutions are remarkable for their satisfactory throwing power. That is, they readily and satisfactorily deposit the cobalt in the indentations of the work.

These two rapid solutions operate at these high speeds in a perfectly still solution without agitation of any kind.

These solutions are both cleaner, that is free from creeping salts and precipitated matter, than the standard commercial nickel baths.

The cobalt deposited at this rapid speed is very much harder than the nickel deposited in any commercial nickel bath. Consequently a lesser weight of this hard cobalt deposit will offer the same protective coat as a greater weight of the softer nickel deposit. Considering solution XIII B, operating at 150 amperes per square foot, on automobile parts, brass stampings, etc., etc., a sufficient weight of cobalt to stand the usual commercial tests, including buffing and finishing, is deposited in one minute. With the best nickel baths, it takes one hour, at about 10 amperes per square foot, to deposit a plate equally satisfactory. Therefore, the actual weight of metal on the cobalt plate must be approximately one-quarter that of the nickel.

For many purposes, under the condition of these rapid plating solutions, one-fourth the weight of cobalt, as compared with nickel, is required to do the same protective work. Consequently, if nickel is worth 50c a lb., in the anode form, cobalt could be worth nearly $2 a lb., in the same form, to be on the same basis, weight for weight of metal. In addition there are other advantages of cobalt in saving of labor, time, overhead, etc.

With cobalt a smaller plating room would handle a given amount of work per day than with nickel.

With these very rapid plating solutions, by the use of mechanical devices to handle the work, the time required for plating, as well as the labor costs may be tremendously reduced. Solution I B, and particularly solution XIII B, are so rapid as to be revolutionary in this respect.

Obviously the cost of supplies, repairs, etc., would be less with cobalt plating than with nickel plating, as the size of the plant for a required amount of work is less.

The voltage required for extremely rapid cobalt plating is greater than that for most nickel plating baths, it is not so great but that the machines at present in use may be general to operate. For the same speed of plating, the cobalt solution requires much the lower voltage.

For a given amount of work the power consumption for this rapid cobalt work is less than that for nickel. This is obvious, because the total amount of metal deposited in the case of cobalt is very much less, whereas the voltage at which it is deposited is not correspondingly greater.

Ornamental work on brass, copper, tin or German silver would require only a one-minute deposit. Even warm exposure to severe atmospheric influences, or friction, could be admirably coated with cobalt in solution XIII B in fifteen minutes. The tremendous possibilities of this solution are not to be completely realized unless mechanical devices are applied to reduce hand labor to a considerable extent.

Thick deposits from these solutions are vastly superior to any that we have seen produced from nickel solutions. The tendency to distort thin cathodes is less pronounced, while electrotypes and electrodies have been given a superior thick deposit in a most satisfactory manner. The lines were hard, sharp and tough and the surface smooth. Nickel does not equal cobalt for excellence of massive plates.

Many of these tests were passed upon by uninterested skilled mechanics at the plant of the Russell Motor Car Co., who invariably reported in favor of cobalt as above.

Both solutions I B and XIII B are substantially self-sustaining, once they are put into operating condition, and the amount of ageing required to do this is very much less for them than that for the present commercial nickel baths.

ALUMINUM.

The Aluminum Co. of America controls production of aluminum in Canada and the United States with practically no opposition.

The $20,000,000 capital stock is understood to be held by a very few persons, the predominating interest being the Mellon family of Pittsburgh. The company makes no statement of earnings, nor will it give a record of its dividend payments. The latest available financial statement showed that an undivided surplus of $6,400,000 existed on January 1st, 1908, which compared with $3,300,000 in August, 1906.

There have been bids of $320 a share without bringing out any stock, against a nominal quotation of $250 a few weeks ago. What gave promise of furnishing competition to the Aluminum Co. of America was the activity of the Southern Aluminum Co. backed by French capital prior to the outbreak of the European war. Its construction programme has been greatly curtailed and production has yet to start.

CONIAGAS.

The directors of Coniagas mines have decided not to pay the dividend that is usually paid on November 1st. The reason officially given for this step is that as the result of prices that have ruled for bar silver, there has been little inducement to operate freely. The company has limited its output accordingly.

While the official statement of ore reserves and developments will not be made known for a month yet, when the annual meeting takes place, reserves have not been diminished. Up to October 31st, 1914, the company paid $7,240,000 in dividends on a capital of $4,000,000. This year to date it has paid 15 per cent., or 600,000. During [illegible] paid and 20 per cent. in 1914.

THETFORD.

Quebec, Oct. 21.—The striking miners at Thetford all returned to work this morning, following an agreement reached yesterday afternoon. The [illegible] plant.

The labor trouble has not yet been settled at Robertson, where the [illegible] adjustments are anticipated in a short time.

THE BEAVER LAKE DISTRICT, SASKATCHEWAN AND MANITOBA*

By Wm. McInnes.

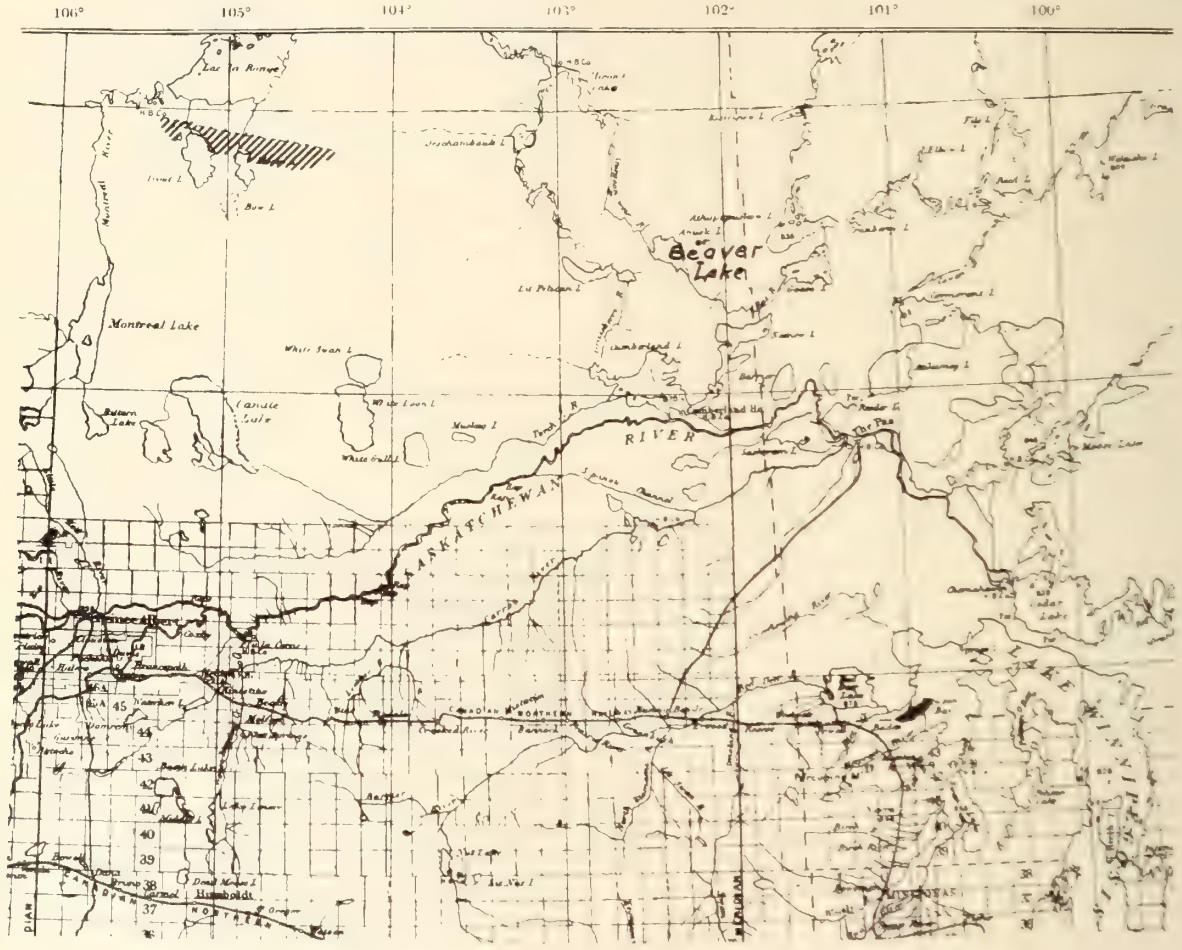
During the summer of 1906 the writer descended Nelson river to Split lake and made an examination of the region lying between that lake and the Pas, on the Saskatchewan. During the course of the exploration Burntwood, File and Grass rivers were examined, also the lakes lying north of the Pas. In 1907, Carrot river was surveyed, and the northern and eastern slopes of the Paskwia hills were examined. In 1908, a survey was made of Southern Indian lake, which occupies a large basin in the Churchill valley in latitude 58 degrees, and the Churchill river was examined between that lake and Lac LaRonge. In 1909, Wapawekka lake was surveyed and a large part of La LaRonge; an examination was also made of Neweiben lake and part of Churchill river above the mouth of Rapid river. In 1910, Deschambault lake and river and Grassberry river were surveyed, and an examination was made of Amisk or Beaver lake and of Candle river and the western part of Cumberland lake.

The remaining portions of the region covered by map sheet 38A, compiled by the writer, have been examined more or less closely by many different explorers, including Bell, Cochrane, McConnell, Tyrrell, Low and Dowling, all of the Geological Survey.

The southern part of the area mapped may now be reached by the Prince Albert branch of the Canadian Northern railway, and by a branch constructed from the main line to the Pas on Saskatchewan river. (Motor boats ply between the Pas and Cumberland Ho and the northern end of Namin lake, from whence there is a wagon road to Beaver lake.)

The proposed Hudson Bay railway when built will make the northern part more accessible, but the greater part of that area will, even after the building of the railway, be reached only by means of canoes and York boats or other craft suitable for navigating swift rivers, where numerous falls and rapids necessitate many portages.

Except a small part of the southwest which lies in the half wooded country, the region under consideration is too densely forested to be easily accessible by cart or pack train. The rivers and lakes form the highways of travel during the season of navigation which, over most of the district, extends from early in May to late in October. Owing to the steep gradients, rapids, and falls of most of the rivers, and to the necessity, on many of the routes, of crossing by portages from one watershed to another, boats must be used that are convenient-



Map showing location of Beaver lake, near Saskatchewan-Manitoba boundary.

*Extracts from Memoir No. 30, Geological Survey of Canada, "The Basins of Nelson and Churchill Rivers." By Wm. McInnes, 1913. The district is now being surveyed by Mr. E. L. Bruce, of the Geological Survey. Mr. Bruce's preliminary report was published in the August 1st, 1914, issue of the Canadian Mining Journal.

ly carried or dragged overland. For light travel, the bark canoe of the Indian, or its improved form, the cedar, basswood, or canvas-covered canoe of the white man, is best suited, since it is manageable in rapids and is easily carried on men's shoulders. For heavy transport the more strongly built and larger boat, known as the York boat, used generally by the fur brigades, is well adapted. It is propelled by sweeps or by sails on smooth water, and is poled or towed with a tracking line up the swift currents of the rivers. Where portages must be made the boat is dragged overland with the help of skids and rollers.

In the winter season snowshoes and dog-trains offer a means of travel, that though somewhat laborious, is fairly expeditious.

Saskatchewan River.—The river is navigable, except during periods of low water, by shallow draught, high power river steamers, from the head of the Grand rapids, at its mouth, to Prince Albert and beyond. Rapid current, tortuous channels between islands, and shifting sandbars make the services of a skilled pilot necessary for safe travel in the present unimproved state of the channel. Improvements, that are now under contemplation by the government, will remove many of the difficulties of navigation and make the river a fairly good water route.

The trip downstream on the river by small boat or canoe is an easy and delightful one. The continuously rapid current makes the labor of paddling light, and all the rapids may be run with ease except Grand rapids, just above Lake Winnipeg, which is passed by means of a tramway 3½ miles long, or by running part of the way and making a portage 87 chains long. The ascent of the river, on the other hand, is most laborious; the current is too strong for paddling and the water is too deep generally for poling; tracking must be resorted to for almost the whole distance between the Pas and Prince Albert. For tracking, which is the method used in ascending all swift flowing rivers in the northland, a long, light tow-rope is used; it is manned by part of the crew, one remaining aboard to guide the boat; the trackers trudging along the rough shore and climbing many obstacles, tow the boat upstream at the rate of a fast walk.

A very large part of the area under consideration is underlain by a complex of old Pre-Cambrian rocks, most of which have the lithological characters and associations of the Laurentian which covers so large a portion of northern Canada. Included in the Pre-Cambrian complex, however, are rocks which from their lithological character and general aspect and composition seem to correspond to the Grenville series of eastern Canada; others which correspond in like manner with the Keewatin of the east, and others [illegible] Keewatin in the general folding, which seem to be [illegible] middle Huronian.

No part of the region has been [illegible] most of it has not yet been even visited by the prospector. There are various belts of Keewatin and Huronian rocks, which from the experience gained in areas of similar rocks elsewhere in Canada, for example in the Cobalt and Porcupine areas, in the Thunder Bay and Rainy River districts, and in other localities, must be looked upon as affording promising fields for the search for valuable minerals. In the newer rocks, the oil-shales of the Pasquia hills are of some promise, and the discovery of the occurrence of coal, north of Prince Albert, may be followed by the finding of seams of commercial importance.

Keewatin Rocks.—Many small areas of rock that, from their lithological character and relationship to the granite gneisses, are considered to be referable to the Keewatin, occur throughout the area mapped. A number of these areas are situated at the southern edge of the Pre-Cambrian area where it is overlapped by Palæozoic sediments. They are roughly triangular in shape, the base of the triangle being formed by the edge of the overlying sediments and the apex by the tapering end of the belt which fades into the gneiss s. The shapes of the areas are such as to make it seem probable that they are tongues extending northward from larger areas or perhaps from a continuous area of these rocks, concealed beneath the flat-lying sediments and protected by them, from the denudation that, during much of the time that has elapsed since their deposition, was active in the northern area.

Enumerated in order of their occurrence, from west to east, the areas that are considered to be referable to the Keewatin are: A narrow belt, extending easterly from the south shore of Wapawekka lake; an area 50 miles wide which appears from beneath the limestone cover at Beaver, Athapapuskow and Cranberry lakes; similar areas at Reed and Wekusko lakes; one crossing Grass river below Wekusko lake; a small area at Pipe lake, Burntwood river; an area of very irregular outline at Cross lake on Nelson river, which is probably continuous with a more extensive belt crossing Oxford and Knee lakes; and, in the southeast corner of the district mapped, a number of small tracts about Gods lake and Island lake and a long, narrow belt, which has been traced for upwards of 100 miles along the upper courses of Severn river.

The belt on Wapawekka lake is a little less than four miles wide and trends east and west. To the south it is overlapped, in its western part, by the flat-lying sandstones of the Cretaceous, and in its eastern part is cut off by a bright red intrusive rock, which has the composition of a quartz-diorite, the bulk of the rock being composed of plagioclase feldspar, quartz being abundant and biotite occurring in quantity amounting to about 10 per cent. of the whole. The rock has the aspect of a granite.

The rocks of the belt are mainly massive dark, greenish-black quartz-diorites, sheared in places to form schists; hornblendites, hornblende schists, and quartz-[illegible] schists and fine gneisses. Along the south [illegible] of the narrows a very highly altered rock, which is used by the Indians for the manufacture of pipes, occurs in low cliffs. In appearance it is a soft, light colored, greenish-grey rock dotted with small, bright red spots. It seems to have consisted, originally, almost entirely of hornblende, with accessory feldspar and magnetite, but is now strongly chloritized. To the north, it is difficult to fix the edge of the belt. Quartz-diorite schists and schistose rocks having the appearance of dacites are intermingled with the gneisses. The [illegible] rocks giving place, apparently somewhat gradually, to a granitoid structure until the gneisses assume the appearance of so-called Laurentian gneisses.

The Beaver lake belt, where the rocks are exposed about the shores of that lake, is made up of various forms of schists that are characteristic of the Keewatin, for the most part hornblendic and chloritic, and massive diorites, with, in smaller volume, rocks of the quartz-porphyry type and soft, grey, calcareous schists. The schists are generally [illegible] and [illegible] rocks of this belt are exposed farther to the east, in

Cranberry and Athapapuskow lakes, they have been described by Tyrrell* and Dowling.† On Athapapuskow lake, Dowling found mainly chloritic and hornblende schists and massive diorites, the general trend of the rocks being about northeast. Towards the more northerly extension of the area, along the outlet of the lake, quartz porphyries cut the schists and there occurs a band, west of the quartz porphyries, of well marked conglomerate with pebbles of red jasper, that is probably of lower Huronian age. Acid intrusives cut the basic rocks at many points.

On Cranberry lake, Tyrrell describes the rocks as consisting mainly of "chloritic and sericitic schists, altered from diabases or clastic slates, cut by massive diorites and gabbro."

The Reed Lake area and its extension down Grass river and about Wekusko lake are, like the tract to the west, underlain mainly by various dark colored schists and diorites, but include quartz-porphyries and other acid intrusives.

relationships of the conglomerate were not made out. It seems to be invaded by the felsites which form a marginal phase of the main granite mass, and which are in places quartz-porphyries, but includes pebbles that seem to be quite similar to the felsites and quartz-porphyry.

The matrix of the conglomerate is made up of rounded particles of quartz-porphyry and felsite, cemented by interstitial crystaline quartz and chlorite; associated with the conglomerate and apparently merging on the one hand into it and on the other into quartz-porphyry is a breccia composed of irregular masses and smaller fragments of quartz, feldspar, aplite, felsite and quartz-porphyry, arranged in a promiscuous manner in a ground-mass of the same composition.

The conglomerate in its extension along the strike northerly becomes schistose in structure, and passes upwards into a fine grained, quartz epidote rock, containing carbonate, which may originally have been a limestone.

Sketch map showing Keewatin areas (marked xx) in Beaver Lake District

The exposures about Reed lake are for the most part hornblende schists and massive, altered, dark green diorite-like rocks. On Grass river, below the lake the Keewatin is represented by massive quartz gabbros and coarse diorites which cross the river, in a belt about a mile wide, at the falls. At the first lake-like expansion of the river, which occurs about 6 miles below Reed lake, the Keewatin rocks form a very narrow belt with intrusive red granites on both sides of it. From a point opposite the inlet, northerly, for several miles, the rocks of this belt form a narrow fringe along the shore, the granite which lies to the east, or a red felsite which seems to be a marginal phase of the granite, coming to the shore from place to place in masses and tongues. An interesting conglomerate, which holds pebbles of red felsite, quartz-porphyry, white quartz, granite, and banded red jasper, forms part of the belt, indicating that, probably, Huronian strata are folded in with the Keewatin. The conglomerate on the Pineroot river, described by Dowling,‡ seems to be of similar character. The exact

This narrow belt, which skirts the sides of the lake expansion and continues down the valley of Grass river, forms a connecting band between the Keewatin area of Reed lake, referred to above, and the larger area of these rocks exposed about Wekusko lake.

The rocks about Wekusko lake are, for the most part, diorites and schists derived from them, but embrace also many other rock types characteristic of the Keewatin, including hornblende and staurolite schists and nacreous, silvery schists derived from acid intrusives. The rocks of this area are cut by a great number of quartz veins, which vary in width from mere gashes to veins several feet wide. None was observed to carry valuable minerals.

The belt which crossed the river below Wekusko lake is separated from the lake area by a broad band of granite and granitoid gneiss. The surface is here largely drift covered, and few exposures are seen along the river. Those which outcrop are hornblende and chlorite schists and diorites.

*Geol. Survey., Canada, Annual Report Vol. XIII., 1890, Pt. F.
†Geol. Survey., Canada, Annual Report Vol. XIII., Pt. FF.
‡Geol. Surv., Canada, Annual Report Vol. XIII., p. 33 FF.

Like the last named, the small area crossing Pipe lake and extending easterly, just south of Burntwood river, is made up mainly of chloritic and hornblende schists, and has apparently a trough-like structure, infolded in the enclosing granitoid gneisses.

Pipestone lake and part of Cross lake, Nelson river, lie in the western extension of a long belt of Keewatin rocks which extends eastward to Echimamish river and beyond, for a long distance down Hayes river. The rocks exposed about Pipestone and Cross lakes are principally chloritic and hornblende schists, diorites and a conglomerate with schistose paste and pebbles of granite and diorite principally. The rocks of the belt are described in greater detail in the portion of this report dealing with Nelson river and the Hayes River route. They seem to occupy, towards the granite gneisses, the same relationship generally observed in northern Ontario, that of areas infolded in the granitoid rocks but also invaded by them.

Of the areas in the vicinity of Gods lake and Island lake, our knowledge is derived from notes made by A. S. Cochrane, accompanied by a set of specimens and a map. The information is not sufficient to allow of the exact mapping of the areas. The rocks seem to consist mainly of hornblende and other schists and diorites, and they seem to have a very irregular distribution, but whether they occur in a number of small unconnected tracts or form two principal areas, it is not possible to say. Mr. Cochrane noted the occurrence of serpentine on the north shore of Island lake, and found very strong magnetic attraction at an island which he calls Iron island in the same neighborhood.

The belt of Keewatin extending from Favourable lake to Sandy lake and down Severn river, was mapped by A. P. Low, who describes the rocks as consisting mainly of chloritic and altered hornblende rocks, with talc and hydro-mica schists. They were found in several places to be highly magnetic and to contain large quantities of pyrite.

Huronian Rocks.—Included in the areas of Keewatin rocks mapped, are certain conglomerates, which from the fact that they hold pebbles that seem to have been derived from the Keewatin—for example, pebbles of banded jaspar—are deemed to be younger than Keewatin; they are folded in with those rocks and no attempt has been made, on the accompanying map, to separate the two.

Beaver (Amisk) lake is a roughly rectangular body of water 18 miles long by 12 miles wide. The southern half is broken by only a few islands, but the northern half is nearly all occupied by one large island around which the lake wraps in a narrow belt. This is one of the numerous class of lakes which are strung along the edge of the Palæozoic sedimentary rocks, lying partly in them and partly in the Pre-Cambrian. All the northern shores of the lake are well wooded, principally with spruce which over certain areas is of good size. The south shore and part of the east shore are underlain by magnesian limestones, which in many places show cliff faces fronting the water. The rest of the shore lies in the Pre-Cambrian and shows generally smoothly sloping surfaces, though a part of the country adjoining the east shore, which is underlain by massive diorites, is rugged and rises abruptly from the water with steep slopes and in places precipitous walls.

The forest over all the region surrounding the southern portion of the lake which is crossed by the main boat route, has been repeatedly swept by fires; but to the north a large area is still covered by spruce of good size.

Whitefish and lake trout are plentiful in the lake.

Reed lake is about 12 miles long and 6 miles wide. It combines the features characteristic of the lakes of the Pre-Cambrian area and those of the limestone area.

The northern portion of its basin, lying in an area of Keewatin rocks, has a deeply indented shore-line and many islands, while the southern portion, bordered by limestones, has a much more even contour and very few islands. The land surrounding the lake is generally quite low, and to the south is covered by a mantle of drift with occasional low ledges of limestone. The northern part is characterized by rocky shores with many irregular points and bays and a great number of small islands.

The forest about the shores includes poplar, white birch, jack-pine, spruce and tamarack of 35 years' growth, with a few small areas of older trees. Fish are plentiful in its waters and of good quality.

Routes to Reed lake and Grass river.—Reed lake is most easily reached from Cumberland by way of Goose river and lake and the Cranberry Lake route. Although it is necessary to make one long portage leading to Cranberry lake and to pass a number of rapids on the rivers traversed, this route is not a bad one for canoes. A shorter but more difficult route leaves the Saskatchewan opposite the Pas by a good road 13 miles long leading to Atikameg lake, from which a short portage leads to Cormorant lake. From Cormorant lake, the inlet, Cowan river, is followed to its head. The stream, in its lower part fairly large, becomes gradually smaller and eventually is lost in a broad swamp which must be crossed to Reed lake.

Grass river flows from Reed lake as a river of considerable size. To the first expansion, a distance of 6 miles, the current is generally swift and in places rapid; two portages are made past falls of 10 and 5 feet respectively. Ten miles of quiet water, where the river has the character of a long, narrow, rock-bound lake, lead to a river-like portion where the current is strong, terminating in a rapid, down which the river descends 18 feet to **Wekusko lake**: a broad expanse of moderately clear water with bold, rocky shores, which at its southern end touches the base of the high escarpment; marking the northern edge of the belt of Ordovician limestone. Below the lake for nearly 20 miles the river has again the character of a narrow lake, with high, rocky shores and an almost straight course. Just below the end of this lake-like portion, three heavy rapids occur where a belt of schists crosses the valley.

Below these rapids the banks for a mile and a half are formed of a more or less open terrace from 10 to 15 feet above the water. Then the river turns sharply and flows for 5 miles southward on the east side of a high ridge of dark green schist, probably altered diabase. From the foot of the ridge it swings round again in an easy curve towards the northeast, passing some hills of dark green, highly altered diabase which rise in the middle of a wooded valley.

At Pipestone lake, [illegible] and hornblende schists, diorites, and conglomerates infolded in the gneisses, to which it conforms in strike. The conglomerates are made up of a schistose [illegible] matrix enclosing well rounded pebbles principally of granite but including diorites. Near the northern edge of the belt, ledges of a very highly altered chloritic rock, probably derived from a hornblendite, occur. This is the rock used by the Indians for pipe bowls, and gives the lake its name.

Climate.—The best proof, perhaps, that the climate of this region, at least as far north as Churchill river, is not too severe for the pursuit of agriculture, lies in the experience of those who have made the experiment. Of the Saskatchewan valley, there is no need to write, since it is well established that in it the climatic conditions are quite suited for the growth of ordinary cereal crops.

In the part of the region which is still mostly wilderness there are necessarily few examples of actual cultivation to cite. At the posts of the Hudson's Bay Co., which are scattered through the country, some attempt is usually made, by the officer in charge, to cultivate at least a kitchen garden; and at a few of the posts, as well as at missions of the Anglican and Roman Catholic churches, in some cases more ambitious attempts at farming have been made. Thus, at Stanley, on Churchill river, wheat, oats and barley have been successfully grown; in the Nelson River valley, wheat has been grown at Norway House and at Cross lake, and barley has been grown at Oxford House. Ordinary garden vegetables are grown annually at all the above-mentioned localities, as well as at Nelson House on Burntwood river, at Pukkatawagan on the Churchill, and at the posts on the shores of Hudson bay.

THE SILVER SIDEWALK.

Cobalt, Oct. 22.—The famous "silver sidewalk," which in the early days of Cobalt provided one of the principal sights of the camp, is being removed. On account of the rarity of such a specimen, the Ontario Government has decided to purchase it from the La Rose company and the work of removing it is proceeding under the direction of Mining Inspector MacMillan, of Toronto. In order to preserve the richest portion of the famous "sidewalk" in its relative state, with the flat, scratched surface showing the effects of glacial action, great care is being exercised in the work of removal. Instead of blasting it, as in ordinary mining, drill holes are driven close together in a row under the portion being removed, and these are filled with unslaked lime. Before these holes are plugged tightly with wooden pins, they are filled tightly with unslaked lime, and a small quantity of water poured in. The slaking of the lime will within a few days expand sufficiently to slowly force the portion upwards. Only about one foot in depth of the vein in being taken, and this is in two separate pieces, which, when broken out, will weigh approximately 900 to 500 pounds respectively.

GRANBY CONSOLIDATED.

For the first time in its history the Granby company monthly production reached the 4,000,000-lb mark in August at 4,047,421 lbs.

This was due entirely to a record-breaking output from Hidden Creek—2,557,362 lbs., against 2,264,615 lbs. in July.

Four furnaces, comprising the entire battery, were in operation at the new smelter in August, it having been decided by the management to blow in the new furnace which had been built primarily as a reserve stack.

The old smelter at Grand Forks turned out 1,489,059 lbs. of copper in August, against 1,624,782 lbs. in July.

Operations at the two Granby smelters compare:

August:	Hidden Creek	Grand Forks
Copper, lbs.	2,557,362	1,489,059
Silver, oz.	35,602	21,189
Gold, oz.	1,230	4,019

ALUMINUM.

Sixty cents a pound has been paid for aluminum on top of the most sensational rise the metal ever had. Two months ago aluminum was quoted nominally at around 30 cents a pound, but a sudden demand has since carried the metal to a new high level.

Extraordinary conditions surround the advance—a diminishing supply to meet a heavily increasing demand. Prior to the European war aluminum was imported from England and France, but in the early stages of the conflict each of these countries placed an embargo against further exportations, shutting off outside supplies to the United States.

The Aluminum Co. of America dominates the production of the United States, as no competition worthy of the name has yet materialized. Before the embargo from France and England became effective there was brought into this country a fair tonnage by two importing interests. This has been fed out on an advancing price scale, and has now been practically cleaned up, leaving the Aluminum Co. in sole control.

Between January 1st and July 31st, 5,842,129 lbs. were brought into this country, against 9,087,575 same time last year and 17,260,222 lbs. two years ago.

War orders have been largely responsible for the big increase in demand for aluminum. Canteens, numbering many thousands, have been ordered in the United States for European armies to be made from this metal. Time fuses have also been a big factor in the consumption of aluminum, while the demand from automobile manufacturers has been of extraordinary proportions.

The Northern Aluminum Co., operating a plant at Shawenegan Falls, Quebec, a subsidiary of the Aluminum Co. of America, is a large producer, exporting 14,510,000 lbs. in 1914.

STANDARD SILVER-LEAD MINING CO., SILVERTON, B.C.

A statement has been sent to shareholders of the Standard Silver-Lead Mining Co., operating the Standard silver-lead-zinc mine and concentrating mill, situated near Silverton, Slocan lake, British Columbia, from the company's head office in Spokane, Washington, giving particulars of receipts, expenditures, etc., for July last.

The statement shows the receipts to include: Preliminary settlements for 1,512 tons of ore, $123,223.54; boarding house, $2,850.50; store supplies, $2,447.75, making a total of $128,521.79. From this is deducted disbursements as follows: Ore production, including supplies and labor, $11,792.47; tramming, $668.63; milling, $2,537.32; power, $341.15; general expenses, $627.51; shipping and selling, $627.60; boarding house, $2,315.23; taxes, $1,800; insurance, $159.35; casualty insurance, $286.50; salaries, $300; a total of $21,500.76, which leaves a relative operating profit of $107,021.03.

Further disbursements for development and experiments amounting to $3,301.36 and home office expenses of $337.07 are deducted, leaving a net profit for July of $103,382.60, which with the balance on hand on July 1 makes a total of $105,063.84.

A recapitulation of the balance reads: Cash in banks, $39,081.68; ore shipped but not settled for, $84,722.96, making a total of $123,804.64. From this is deducted Vouchers, payable, $5,641.75, and pay roll, $13,099.05, a total of $18,740.80, leaving a balance of $105,063.84.

The statement further states that there were 1,100 tons of lead concentrate, 400 tons of crude lead ore and 1,400 tons of zinc concentrate on hand on July 31.

ORES OF WORTHINGTON MINE, SUDBURY DISTRICT, ONTARIO*

By T. L. Walker.

The Sudbury copper-nickel orebodies, as is well known, occur in connection with basic igneous rocks. The rock in the fresh form is norite, but frequently it is so altered that it can be best described as epidiorite or diorite. The orebodies commonly occur on the basic border of the eruptive which becomes more acid and lighter in color as the distance from the ore bearing border is increased. This transition from basic at one border to acid at the other border of the nickel bearing eruptive was first pointed out by the writer† who attributed the variation to magmatic differentiation. The later workers on the geology of the Sudbury region have generally approved this interpretation and have usually claimed that the orebodies are due to magmatic differentiation.‡ Since the chief nickel mineral is nickeliferous pyrrhotite, the copper-nickel ore is referred to as pyrrhotite norite.

The chief mass of nickel-bearing norite forms a continuous band bordering a great ellipse, 35 miles long and 15 miles across. In width this eruptive varies from two to four miles, the outer part of the band being basic and frequently marked by important orebodies, while the inner part is acid and devoid of such deposits. The central part of this great ellipse is occupied by pre-Cambrian sedimentary rocks. The whole complex forms a great syncline, the lowest member being the nickel eruptive which Coleman regards as a great intrusive sheet.

Apart from the main nickel bearing eruptive just referred to there are several more or less irregular masses of the same petrological type. Sometimes these masses are connected with the main mass and project outwards from the ellipse, while in other instances they show no direct connection with the large mass. They are sometimes only a few hundred feet across and several miles in length. Some important nickel-copper orebodies have been found in connection with these smaller, irregular norite masses. The igneous mass with which the Worthington deposit is connected is of this type. It attains a length of four miles without exceeding a few hundred feet in width.

The ore mined at the Worthington mine occurs in a hornblende plagioclase rock in which there is abundant evidence of alteration. In some of the nickel mines of the region fresh norite occurs but generally the pyroxene is more or less altered to hornblende. Owing to the presence of all stages in the alteration it is reasonable to conclude that the epidiorite associated with the nickel ores results from the uralitization of pyroxene. In the case of the Worthington ore this is the chief type of rock observed.

The sulphides prominent in the Worthington ore are pyrrhotite and chalcopyrite, through which are scattered pentlandite in the form of lustrous cleavable phenocrysts of a pale, brassy color and nickeliferous pyrite with subordinate amounts of polydymite and rarely sphalerite, niccolite and molybdenite.

The masses of pentlandite vary in size from particles to be seen only with the lens to masses two inches in diameter. It was in ore from this mine that the writer first recognized the presence of pentlandite in the Sudbury ores. In the Worthington mine the pentlandite is most abundant in the pyrrhotite, but it is also frequent in the chalcopyrite and pyrite. In the other nickel deposits of the district the pentlandite particles are usually microscopic in size. It is now generally maintained that the nickel values of the pyrrhotite are due to the presence of small particles of pentlandite scattered through the pyrrhotite rather than to the isomorphous replacement of iron by nickel. In the Worthington mine the pentlandite is exceptional in that the individual masses of the mineral are microscopic in size. The octahedral cleavage of the pentlandite is such that a fragment examined on the reflecting goniometer gives good reflections for the various octahedral surfaces.

A chemical analysis of some of the purest pentlandite gave the following result:

	Per Cent.			
Fe	30.68 ÷ 55.9	=	.5495	1.1582
Ni	34.48 ÷ 58.7	=	.5870	
Co	1.28 ÷ 59.	=	.0217	
S	32.74 ÷ 32.06	=	1.0212	
Insoluble	.56			
	99.74			

From this analysis it should be observed that the bases are present in proportions too large for the chemical formula [Ni, Fe]S usually given for this mineral. This was first observed by Dickson who suggested that according to a great many analyses made by him the composition was nearer to $[Ni, Fe]_{11}S_{10}$.

An unusual type of ore found at the Worthington mine consists of massive pyrite containing rounded masses of pentlandite. The ore has a conglomeratic appearance and is so abnormal for the Sudbury region as to merit further consideration. The mineral composing the nodules is somewhat dissected by veinlets and stringers composed of ferruginous calcite, while the outermost zone of the nodule is darker in color and weathers very quickly when exposed to the air, giving rise to sulphates and in this way suggesting polydymite. It is slightly darker in color and not so lustrous as is usually the case with pentlandite, while the cleavage is rudely cubic, rather than octahedral. A chemical analysis of a sample from one of the purest nodules (S. G. 4.638) gave the following result:

	Per Cent.
Fe	27.64
Ni	22.43
Co	.01
Cu	.50
S	34.82
CaO	1.58
Insoluble	.78
	98.16

*Extracts from a paper published in Sept.-Oct., 1915, issue of "Economic Geology."

†T. L. Walker, Quart. Journ. Geol. Soc., Vol. LIII (1911), p. 1.

‡Coleman, A. P., "The Nickel Industry," Mines Branch, Ottawa, 1913. Barlow, A. E., Report on the Geology of Sudbury, Ontario. 1900. Report of Ontario Bureau, 1901.

After deducting the iron and sulphur required to combine with the copper to form chalcopyrite the atomic ratios of the four chief constituents are as follows:

Fe	.490	1.052
Ni	.547	
Co	.015	
S	1.075	

Accepting Dickson's formula for pentlandite $[Fe, Ni]_{11}S_{10}$ it would appear that this nodular material is pentlandite with a small amount of polydymite. The deficiency shown in this analysis is probably due to undetermined magnesia and carbon dioxide. In view of the preceding observations the writer is inclined to believe that these nodules are largely composed of pentlandite pseudomorphous after polydymite.

The pyrite is light in color and when acted upon by dilute acid betrays the presence of a considerable amount of carbonate. Thin sections of the pyrite mass show that it is quite porous, being composed in part of solid compact pyrite in part of strings of tiny pyrite crystals cemented by calcite or quartz. Throughout the pyrite mass there is also a very small amount of chalcopyrite. The pyrite upon analysis gave the following result:

	Per Cent.		
Fe	44.57 ÷ 55.9	= .797	.839
Ni	2.44 ÷ 58.7	= .042	
S	51.83 ÷ 32.06	= 1.617	
	98.84		

The carbonates, the constituents of which were not determined, probably account for the deficiency in this analysis. The atomic ratios show that the mineral is too basic for pyrite. It is probably a mixture of pyrite and pentlandite. A similar mineral was reported by the writer from the Murray mine in 1894.§

The type of ore here described is exceptional for the Sudbury nickel deposits. It is difficult to avoid the conclusion that the ores as they are now found at the Worthington mine have been subject to rearrangement by aqueous agencies since the solidification of the rock and sulphides from the original magma. The writer believes it important to emphasize the fact that it is now generally admitted that magmatic segregation alone will not account for all the phenomena observed by the students of the Sudbury orebodies.

McINTYRE AND JUPITER.

President Alex. M. Hay, of McIntyre-Porcupine Mines, Ltd., has issued the following letter to shareholders:

The directors have pleasure in announcing that after protracted negotiations, they have entered into an agreement for the purchase of a controlling interest in the property of the Jupiter Mines, Limited, subject to ratification by the McIntyre shareholders.

The acquisition of a controlling interest in the McIntyre Extension Mines, Limited, reported on August 6th last, was part of a general plan to strengthen the position of the McIntyre company by extending the limits of its operations on orebodies now being worked within its own boundaries, which are known to exist on the adjoining properties.

The McIntyre Extension shaft has now reached a depth of over 700 feet, and it is expected that sinking to 1,000 feet will be completed before the end of the year. This shaft is situated 400 feet from the Jupiter line, and about 301 feet from the McIntyre line, so that it can be utilized as a main working shaft to economically develop and handle ore mined on the north side of the lake from all three properties.

Recent developments on the 500-foot level from McIntyre No. 5 shaft, have opened up a body of high grade milling ore to the east towards the Jupiter line. This vein is in the contact zone which traverses the Jupiter property for a distance of over 2,000 feet from west to east, where, in the Jupiter workings ore of an estimated value of between three and four hundred thousand dollars has already been developed and is available for stoping. McIntyre No. 5 shaft has been completed to the 700-foot level, and cross-cutting will be started this week both on the 600 and 700-foot levels to tap this orebody at these depths.

The price agreed to be paid for a controlling interest in the Jupiter property is $152,000. Of this sum approximately—but not exceeding—$60,000 will be paid to the Jupiter company to enable it to pay off its bonded indebtedness and other liabilities, so that the Jupiter property and assets, consisting of 79 acres with buildings, plant and equipment, will be turned over to the new company, free from all encumbrances. As an offset against this payment, $12,000 worth of mining machinery purchased and paid for by the Jupiter company, but not yet delivered, will be turned over to the new company.

The remaining $92,000 will be available for working capital, and is to be furnished to the new company over a period of eighteen months at the rate of $5,000 per month. This expenditure will be offset by the profit to be realized from Jupiter ore. This ore will be treated at the McIntyre mill at a rate per ton which will leave the McIntyre company a further profit on the operation.

In the erection of the new mill-addition, which is now under way, provision will be made for the treatment of Jupiter ores, and it is expected that the extra revenue to be derived from this source and from the larger operations now contemplated, will more than take care of the expenditures to be incurred in the purchase and development of the new properties.

Production for the months of August and September has been as follows:

August—Tons milled, 9,135; value per ton, $7.24; gross value, $66,193; recovery, $63,371=95.7 per cent.; operating costs per ton milled, $36,553=$4.00; operating profit, $26,817.

September—Tons milled, 8,395; value per ton, $8.37; gross value, $70,268; recovery, $67,143=95.4 per cent.; operating costs per ton milled, $34,419=$4.10; operating profit, $32,723.

UNITED STATES MINING LAWS.

A convention that will act on recommendations regarding a general revision of the Federal mining laws of the United States will meet in Washington, D.C., on December 16th. All the known mining societies in the United States have been invited to send delegates, and it is hoped that the mining industry will be so well represented that the action of the convention will be regarded as expressing the wishes of the industry.

§Walker, T. L., Am. Journ. Sci., April, 1894.

A PAIR OF OLD SNOWSHOES

By J. Harmon Patterson.

(How a white man and two Indians found themselves in a winter wilderness without food or shelter, and how they fought their way out.)

"I have information," so the letter ran, "which I consider reliable, of a large deposit of iron ore lying at the head of the lake marked on enclosed sketch. This plan is only approximate. The lake may easily be twenty miles from the point at which I have shown it, however there is a trapper's cabin on it which may help.

"If you are not now engaged, you will proceed to this place at once, taking such assistants as you may require. With a dip needle you will locate the extent of the orebody, making plan of same, showing readings. Gather such information as may be possible and bring samples."

This letter was from a very prominent mining man in New York, for whom I had done exploring work and who was the owner of large mining interests in Northern Ontario.

It was the middle of January, and the winter had been one of exceptional severity. Nevertheless I decided to make the trip.

On a winter expedition Indians are preferable to white men as guides. They are experts with snowshoes and toboggan and know exactly how to make a comfortable camp even at fifty below. They have a knowledge gained by experience of conditions against which a white man is powerless.

I was fortunate enough to secure the services of the two best men I knew. Indian Charley, tall, straight as an arrow and with the endurance of a wolf, was thoroughly proficient in all matters relating to camp or trail and one of the few Indians I knew who was completely trustworthy. He had been out with me before and I knew his worth. Joe, Wabi-amick, or white beaver, was also a good man, much younger than Indian Charley, but almost his equal in strength and endurance.

I handed the map to Charley who scanned it carefully.

"Oh, yes, I know the place," he said, "Old Paul's shack there, old stove in it. Start from here, maybe get there in seven days. Paint Lake we call it."

"All right then, we get away to-morrow morning," I decided. "We'll take thirty days' supplies on a toboggan."

"Very good," was his reply.

In the midst of a drifting snowstorm and with the temperature forty below we left the little hamlet and were soon swallowed up by the forest. The snow was about five feet deep and very light, so progress was slow. It was nearly dark when we halted for the night, having covered about ten miles.

While I dug a hole in the snow, using my snowshoe as a shovel, the Indians cut a large quantity of wood and brush. A fire was then made and logs about six feet long were piled on. The brush was carefully laid for our bed beside the fire and a large piece of canvas called a fly spread in a semi-circle over the bed and leaning towards the fire. It was held in place by small poles and the snow was banked up behind it. Thus all the heat from the fire is reflected and it is much more comfortable than a tent.

After supper, beans were boiled for the next day. Then putting on an extra sweater I crawled under the blanket.

We had an uneventful trip to Paint Lake which we reached about noon on the seventh day. We found the little shack in good repair; but the sheet iron stove had evidently seen its best days. However, by the use of all the tinware we could find we managed to patch it up.

Next day I set to work to locate the iron ore and for five days we traversed the country around the lake. In a cliff along the shore was a very small deposit and the color had evidently given the lake its name, but it was of no commercial value. Nowhere else could we find even a trace and it was evident that my employer had been the victim of the imagination of some prospector.

Joe had found an old net in the shack. It was in very bad repair, but every evening he had spent some time in mending it. One morning we cut holes in the ice and set the net, as Charlie had informed us that trout were very plentiful in the lake.

After supper we all went down to pull in the net. I had often laughed at Joe about his net, for I did not think it strong enough to hold anything, but to my great surprise he had seven fine trout—a welcome change from the salt pork which we had served up three times a day.

Coming from the lake we noticed a bright red light in the window of the cabin. We ran forward as fast as possible. On opening the door Joe was met by a dense cloud of black smoke. The whole interior seemed a mass of flame. The stove had evidently fallen over during our absence. Both Charley and Joe did their utmost to save the blankets, but they were on the far side of the room. Soon a tongue of flame shot out the door and compelled them to retreat.

Charley saved one axe, and the other had fortunately been left at the lake. Joe brought out a pair of old snowshoes with broken frames, and as we each had a good pair I wondered what he wanted with them.

The logs of the old shack burned bravely, and though we stayed nearly all night it was a case of having your face scorched while your back was freezing. However, no one thought of arranging a bed or trying to sleep. For me the dawn was most welcome.

Conditions and circumstances change values. Cut off by the wilderness as we were, without food and exposed to the intense cold without shelter of any kind, I would have given a thousand dollars for one good pair of Hudson Bay blankets. Of food we needed little, for by fast travel we could reach civilization before we actually starved. But from the cold we must have shelter. We had plenty of matches and could have fire, and though you stand beside it all night turning round and round you get no rest or sleep, I knew by bitter experience just what we were up against.

"Well, boys," I said, "let us see just what we have in the way of outfit. There are our snowshoes, two axes, a fur pail, plenty of matches, an old net and seven trout, and each of us has a knife."

"And one old pair of snowshoes," supplemented Joe.

"Now," I continued, "we are a long way from food and shelter and we can count on nothing less than forty below. What are your plans?"

The silence was broken only by the crackling of the smoldering logs.

"The trail is now broken," said Charley at length, "and we can make our way back in three or four days by going hard, but we must have food and shelter. You wondered why Joe saved those snowshoes. It may be that on the string in them our lives will depend. With it we can make snares and so catch rabbits. With it we can sew birch bark together and make a shelter to take the place of our fly. We have matches and our axes. We have also the net with which we may catch more fish. I have often gone far on less."

"If all this can be done," I replied, "we may yet see our friends again."

The morning was cold and cloudy, but as soon as it was light Joe slipped on his snowshoes and disappeared. Charley was busy preparing breakfast which consisted of grilled trout. He had the pail full of boiling water when Joe returned with a large bundle of what is known as Labrador tea which he had noticed on one of our excursions. When well boiled it had much the flavor of green tea. We drank it from dishes fashioned from birch bark, and I must confess that it was a very creditable substitute for the real article.

After breakfast we again drew the net, but secured only two small fish. Several large ones had evidently broken away, as the holes attested.

Then Charley and Joe set out to gather birch bark, and I spent most of the time until their return in digging among the ashes in the hope of retrieving something of value. I had the luck to find a can containing a good handful of salt.

After another lunch of trout we set to work at the birch bark. I trimmed the sheets while they sewed. They worked quickly, considering the fact that they had no needles, and soon the screen assumed considerable dimensions.

Joe then set to work on the rabbit snares. Supplemented by some twine he had in his pocket he was able to make up twenty. We then set out for a swamp in which we had noticed many tracks. We cut small branches which we stuck in the snow to form a rude fence and in convenient openings we set the snares. This occupied us till late.

On our return we found that Charley had made a comfortable camp in front of a wall of rock a short distance from the shack. We got nine fish that night, and glad we were to get them.

On our return we found a cheerful fire blazing and the heat reflected from the rock and by the screen made cozy and warm the deep brush bed. Then with our feet to the fire we lay down and were soon asleep, but not for long. The cold seemed to come in from beneath, and I awoke chilled to the bone. After getting thoroughly warmed by the fire I lay down again and I repeated the process four times before morning. Not so the Indians, however, for I never saw a movement from one of them.

We got away at earliest dawn taking with us ten trout and six rabbits. Enough Charley said to last us for two days, but we would catch more rabbits, as we would set the snares every night.

I failed to keep up with the Indians, and at noon was far behind. Lunch was ready when I arrived. This consisted of the same unvaried menu—grilled trout and Labrador tea.

"Have big feast to-night," remarked Charley, "boil much rabbit."

"I thought you fellows were never going to stop," I remarked.

"Want to reach swamp to-night," Charley replied. "Plenty rabbit there. We go on very fast, make good camp, set snares. You catch up then."

Throughout the afternoon I travelled fast, but as darkness fell I became very tired and my pace was slow, and I eagerly watched for the gleam of the camp fire.

Suddenly far behind me I heard a low tremulous sound. It grew in volume then wavered and fell. Again it came louder and louder till it ended in a wild yell. It was the gathering call of a wolf and soon it was answered from far and near.

I was out on a small lake and lost no time in reaching the other shore. Half-way across the portage I came to the camp. Both men were cutting wood, as though their lives depended on their work. Tired as I was I helped them draw the logs up to the fire.

"Need plenty of wood to-night," remarked Joe. "Maybe have company."

When a sufficient supply of wood was cut and piled, the pot was put on and the frozen rabbits gotten ready. All the while the fierce cries of the pack sounded nearer and nearer. Still the two men went on with their work undisturbed.

"What about those wolves?" I asked, after an outburst of awful howling.

"Keep us awake all night most likely," replied Charley, wrathfully. "Scare rabbit away or steal any that get caught and spoil good snare."

"Well, if that is all I guess I can stand it," I said, somewhat relieved, "but I thought they were after us."

"They won't come near the fire," he assured me, "just stay around and howl." And that was what they did all night. And howl they certainly could. One would make a start as though trying to get some chord. When he reached a certain pitch the others would join in. And an awful chorus it was. Sometimes I could see shadowy forms outside the circle of light, but they never came close.

It was very little sleep I had all night. Charley and Joe took turns at watching and keeping the fire burning brightly, and it was a long dreary night. But as the gray dawn came stealing over the trees the howling grew less and our unwelcome company slunk away.

When Joe returned from gathering his useless snares he was dragging a great gray, shaggy brute with him. One of the wolves had got into a snare and failing to break the tough rawhide string had strangled.

The men were greatly pleased. "He keep you awake last night," said Charley to me. "You sleep warm in his hide to-night you bet."

While skinning the animal Charley informed me that we had covered all of twenty miles, and if the wolves did not bother us he hoped to do as well to-day.

"Surely they won't trouble us during the day?" I asked.

"Not likely," was his reply. "Still we will have to keep together and make camp early. Then if we get no rabbits we must go hungry and hungry man can't travel fast."

The cold was very keen and a sharp wind caught us in the open while the lowering clouds threatened snow. Noon passed and still no sign of a pause. "How about lunch?" I inquired.

"Guess we won't stop to-day," replied Charley, "have to quit early you know, and not much to eat anyway."

I was utterly spent when we reached the jackpine grove in which they had decided to camp. As we had heard nothing of the wolves Joe went out to set snares while Charley and I did the work. Soon a dismal howl informed us that our attendants were not far away. With some haste I made up the fire, and Joe coming

in assisted. The brutes were soon all around us. Drawn by the smell of the cooking rabbits two of them came so close that I thought they meant to attack us, but as Joe threw a blazing fire brand they fled howling away.

In spite of the warm wolf skin I did not get much sleep. Once, after a fitful sleep I awoke with the cold and sought the fire. Joe was on watch. Ranged in a semi-circle, not a hundred feet distant, I counted eight dim shadowy forms.

"How many in the pack?" I asked.

"Eleven." he replied. Picking up a blazing brand, he threw it towards the wolves which scattered with frightened snarls.

"Wish I had my rifle," remarked Joe. "You bet wolves soon go."

"One rabbit left," remarked Indian Charley, after our meagre breakfast next morning. "Must travel fast to-day and get out to-morrow."

And travel fast we certainly did. Late in the afternoon, when about the middle of a lake some three miles wide Charley, who was in the lead, suddenly sank into an air hole. He instantly threw himself forward, but the damage was done. His feet and ankles were soaking wet. He ran with all speed to the shore followed by Joe. With all possible haste a fire was kindled, and his frozen socks removed, but both feet and ankles were severely frozen, so intense was the cold. We took out the frost with snow, and though I knew that they must pain him severely he made no complaint.

Fortunately we heard nothing of the wolves, so we made camp. One rabbit made a very small supper when divided into three, so we went hungry to bed.

It was about midnight when I was awakened by Joe. The snow was beating in upon us and a fierce storm was raging. We changed the shelter to the other side of the fire, but still the gusts of snow laden wind eddied in upon us. Tired, sleepy and cold, we sat by the fire for the remainder of the night. How many times I consulted my watch I do not know, but each hour seemed interminable.

"Any chance of making it to-day?" I asked anxiously.

"Afraid not," replied Charley. "Don't think I will be able to walk. Joe pull me on toboggan. Joe get hungry and can't go fast."

As soon as it was light Joe looked at his snares. He had two rabbits. One we ate for breakfast. What a small morsel it was! Then with Charley on the toboggan we set out.

Towards evening the storm ceased, but the cold increased in severity. We ate the last rabbit, but it did not stay the fierce hunger which gave us no peace. There was no sleep that night. It was all we could do to keep from freezing. We were told next day that it was fifty-five below zero. One thing alone stayed us up—we were only five miles from warmth and food. Never was night so long. The heat from the fire did not seem to reach the bed at all. It was necessary to stay close and continually turn around.

It was late in the afternoon when our little procession reached the hunting lodge at the railway. Indian Charley was helped into the house and as soon as possible a good meal was ready. It would not have appealed to an epicure, but to us it was all that could be desired. I ate sparingly, but I think that Charley and Joe made up for nearly all the meals they missed. The next train took Charley and me to the nearest doctor, under whose care he soon recovered.

PERSONAL AND GENERAL

Mr. R. B. Lamb has removed from Toronto to New York, where his office is at 43 Exchange Place.

Mr. W. F. Green, of Crystal Falls, Mich., in in Toronto.

Mr. George T. Holloway, chairman of the Nickel Commission, was the guest of honor at a meeting of the Toronto branch of the Canadian Mining Institute on October 9.

Mr. P. B. McDonald has joined the editorial staff of Mining and Scientific Press, San Francisco.

Mr. Chas. J. Curtin, of Brockville, is superintendent of the Kingdom lead mine at Galetta, near Arnprior, Ont.

Mr. T. F. Sutherland has returned to Toronto from Sudbury.

Mr. Percy E. Hopkins is again at Kowkash for the Ontario Bureau of Mines .

Mr. Cyril Knight is in Toronto.

Mr. A. G. Burrows is at Goodfish lake, Ont.

Mr. J. C. Houston is in Alberta.

Mr. A. M. Bilsky is at Cobalt.

Mr. F. L. Steenman, manager of the Genessee Mining Company, Cobalt, is recovering from an operation for appendicitis.

Mr. M. J. O'Brien is convalescing at Renfrew.

Mr. E. V. Neelands will leave for Georgetown, British Guiana, about November 1.

Mr. F. L. Culver is in California.

At a meeting of the Toronto branch of the Canadian Mining Institute, held on Oct. 9, Dr. T. L. Walker, of the University of Toronto, was elected chairman for the ensuing year. Mr. R. E. Hore was re-elected secretary.

Mr. R. B. Watson has returned to Cobalt from Le Pas.

Mr. Jack Hammel has returned to Toronto.

Mr. Selwyn G. Blaylock, assistant general manager for the Consolidated Mining and Smelting Co., Trail, B.C., was a recent visitor to Victoria.

Mr. Randolph R. Bruce, of Wilmer, East Kootenay, B.C., who some years ago was manager of the Paradise silver-lead mine in that neighborhood, is mourning the death of his wife, Lady Elizabeth, daughter of the Earl of Iddesleigh, to whom he was married in January, 1914. Lady Elizabeth died at Invermere, B.C., on Sept. 27.

Mr. Henry Clark, of Victoria, B.C., representative in Canada of the Head, Wrightson Co. of England, manufacturers of mining and other machinery, will shortly make a business trip to Japan for that firm.

Lieut. Graham Cruickshank, of the 54th Kootenay Battalion, which has been in training for some time at Vernon, Okanagan district, B.C., prior to volunteering for active service had been for several years on the staff of the Consolidated Mining and Smelting Co. at Trail, Ltd., in charge of concentrator operations. [illegible] while in the employment of the company's concentrator at the St. Eugene lead-silver mine in East Kootenay, latterly [illegible] the experimental work done at the company's concentration test plant at Rossland, West Kootenay, B.C.

Mr. S. Duncan Ellis, a graduate in mining engineering from Toronto University, who last year went from Toronto to the Braden Copper Co.'s mines in Chile, and [illegible] months ago returned via eastern [illegible] in England in connection [illegible] the Canadian war [illegible] gazetted a lieutenant in the Royal Engineers, England.

Mr. Peter Cook Perrin, [illegible] forty years ago was [illegible]

covery of good coal in the Crowsnest district of British Columbia, and in earlier years had been a sergeant in the British army in the Crimean war, died in Victoria, B.C., early in October, in his 85th year. About 1880, or a year or so previously, when in charge of a trail-making party then working in Southeast Kootenay, he found some excellent coal that had come down the mountainside in a rockslide. He took samples to his brother, Mr. Wm. Fernie, then Provincial Government Agent at Fort Steele, East Kootenay, and later these were seen there by Dr. Geo. M. Dawson, who had just passed through the Crowsnest district, and had noted indications of the occurrence there of coal, but had not found any seams so large as that from which it was manifest the samples in Mr. Fernie's possession had come. Some years afterward Mr. Wm. Fernie did much prospecting on the Crowsnest coal measures, and eventually interested men in Victoria, B.C., to organize a company, which finally was absorbed by the Crow's Nest Pass Coal Co. of Toronto, and to the operations of which latter are due the establishment of the important coal mining and coke making industry of the Crowsnest district of British Columbia.

Mr. Charles Graham, superintendent of the Corbin Coal and Coke Co.'s colliery at Corbin, in the Crowsnest district of British Columbia, was in the Coast cities of Vancouver and Victoria early in October, attending a meeting of coal mine operators and visiting relatives.

Mr. E. Jacobs, of Victoria, B.C., is traveling in the Kootenay and Boundary districts of British Columbia this month, obtaining data relative to the progress of mining in that province during 1915, for annual review purposes. He went via Seattle and Spokane, Washington, to Fernie and Michel, about the middle of October, and afterward visited parts of East Kootenay in which metalliferous mining is being done. Now the several more important mining divisions of West Kootenay—Ainsworth, Slocan, Nelson and Trail Creek (Rossland)—are having his attention. Later he will visit the larger mines of Boundary and Similkameen districts, and then return to the Coast.

Mr. Dudley Michell, of Victoria, B.C., instructor in First-Aid and Mine-Rescue training for the British Columbia Department of Mines, was at Rossland in October, in connection with the instruction of more of the employees of the Consolidated Mining and Smelting Co. in First-Aid and Mine-Rescue work. The company is giving much attention to the mine-safety movement and is affording its mine employees at Rossland every facility for familiarizing themselves with measures for the protection of themselves and others about them.

Mr. P. L. Naismith, of Calgary, Alberta, general manager of the Canadian Pacific Railway Co.'s Department of Natural Resources, together with several members of his staff, has been investigating conditions affecting the company's mineral, water-power, timber and other holdings in parts of the Fort Steele region of East Kootenay district.

Mr. W. Patterson, of the office staff of the Motherlode Sheep Creek Mining Co., of Sheep Creek, Nelson mining division, British Columbia, has left that province for Ontario, where, it is stated, he will be chief accountant in connection with mining properties in Cobalt district, in which Mr. John McMartin is largely interested.

Mr. H. D. Quimby, who some time since, during the absence in England of the general manager for the Jewel-Denero Gold Mines, Ltd. (Mr. Chas. A. Banks), was in charge of the company's gold mine and 15 stamp mill at Long lake, in Greenwood mining division, Boundary district of British Columbia, has returned to that district. It has been announced that he will be field engineer for the British Columbia Copper Co., which has large mining and smelting interests in Boundary and Similkameen districts of the province.

Mr. Frank A. Ross, of Spokane, Washington, was one of a number of mining and financial men who recently went from that city to Nelson, Slocan and Ainsworth divisions of West Kootenay to visit mining properties which Spokane men are operating. Much was seen during a three days' journey, and the visit proved so instructive and enjoyable that it is proposed to make such an excursion an annual event.

Mr. Anthony J. McMillan is about to return to England after having spent several weeks in the West where, in the capacity of liquidator of the Le Roi Mining Co., Ltd. (in liquidation), he has been in connection with the sale to Coeur d'Alene mining men of the smelting works at Northport, Washington, owned by the Le Roi Co. He left Spokane, Washington, on October 13 for Nova Scotia en route to England.

Mr. J. D. Galloway, of Victoria, B.C., assistant to the Provincial Mineralogist, after having spent several weeks in the Windermere and Fort Steele mining divisions of East Kootenay, has been visiting a number of mines and mineral occurrences in Nelson mining division.

Mr. J. Cleveland Haas, of Spokane, Washington, was again in the Coast district of British Columbia last month, where he is developing a copper property under option of purchase.

Mr. Andrew G. Larson, who now makes Spokane, Washington, his headquarters, was in the Slocan district of British Columbia about the middle of October, arranging for a resumption of production at the Lucky Jim zinc-lead mine.

Mr. W. Yolen Williams, of Spokane, Washington, who from 1896 onward, until the time that control of the Granby Consolidated Co. passed to New York men, directed mining operations at the company's big copper mines in Boundary district of British Columbia, recently made a three days' trip through Nelson, Slocan and Ainsworth mining divisions of that province. Among the properties he visited were the Slocan Star, near Sandon, and the Bluebell, on the eastern shore of Kootenay lake.

Mr. F. R. Wolfle, of Spokane, manager for the Florence Mining Co., was at the company's mine near Ainsworth, B.C., for about a week in October. Shipment of both crude silver-lead ore and concentrate from the mine to the smeltery at Trail is shortly to be commenced.

Mr. J. K. Cram, of Kimberley, B.C., superintendent of the Consolidated Mining and Smelting Co.'s Sullivan Group lead mines in East Kootenay, is on a vacation, during which he is visiting Eastern Canada.

Mr. W. R. Wilson, of Fernie, B.C., general manager of the Crow's Nest Pass Coal Co., has recovered from a severe cold which for a short time threatened to develop into pneumonia.

Mr. Thomas Russell, colliery manager at Michel, Southeast Kootenay, for the Crow's Nest Pass Coal Co., spent the latter part of October with his family at Vancouver, B. C.

SPECIAL CORRESPONDENCE

COBALT AND GOWGANDA

The party representing the Fasken and Earle interests which went out to a point 100 miles west of La Pas to look at a gold property there has returned. Samples were carefully taken and these are now being run. Until such time as results from these have been determined, it is premature to say anything more than that the prospect is promising. It is a large sulphide orebody with a mixture of basic metals as well as some gold and silver. It is situated on a small lake about half way between Beaver and Herb lakes. The trip is by water up the Saskatchewan river for 100 miles and then back to the west for about three days' journey up a string of streams and lakes. The property was found by prospectors with whom Jack Hammel is associated and it was Mr. Hammel who brought the prospect to the attention of Mr. Fasken in Toronto. The whole of the country for about 125 miles running east and west between Herb and Beaver lakes is reported to be of good prospective value as a mining section. The rock is similar to the formation of the Northern Ontario rock carrying the ore producing veins of the district. It is not anticipated that the ore will run high, but if its gold and silver contents are only relatively low the size of the deposit should make it attractive.

The Crown Reserve Mining Co. has decided to take up their option on the Globe Consolidated mine in Trinity county, California. Operations under Mr. Burnett, of the Crown Reserve staff, have already commenced. Under the agreement the Crown Reserve Mining Co. will spend $50,000, at the rate of $4.000 a month. This will be returned out of the gross ore receipts, 60 per cent. going to the Crown Reserve until the amount is paid. After this is paid the profits will go to liquidate debts which amount to $140.000 on a mortgage and $112.000 in notes. For this expenditure the Crown Reserve gets a 55 per cent. interest in the company on a thirty-year lease. Some three years ago Sherbrooke business men took over the Globe Consolidated from the Globe Mining Co. They paid $300,000 for the property and agreed to return this on the basis of 50 per cent. of the gross returns. As the ore only runs $9.00 a ton this agreement left small profit per ton for the operating company. Some months ago the output became so low that the company decided to try and induce outside capital to help them. With this, they approached the Crown Reserve Mining Co. and after some negotiations obtained the assistance they desired. The Southern Pacific runs within 27 miles of the property; railhead being at Reading. Transportation is by automobile. The mine is fully equipped and working has not ceased. There is a cyanide mill with a capacity of 125 tons a day. There are two known ore vein systems, one of these is the Globe vein, which is six feet wide with a known ore shoot of 1,500 feet. The other is the Bailey which can be seen 500 feet below. The idea of the management is that if raises can be put through from the adit level of the Bailey vein the orebody of the Globe can be mined at much lower cost. After some work development money ran out before any ore was struck. To-day the Crown Reserve is sinking a winze from the Globe vein and sinking is still in ore at twenty feet down.

The Rochester mine now being worked by the Temiskaming Mining Co. has found a little ore on the 300 foot level. This ore is very patchy so far and consists of bunches of smaltite with quite a little native silver in it, running well over 2.000 ounces on the average. It will be followed still further in the Rochester territory and a raise will be put upon it.

The Miller Lake O'Brien Mining Co. at Gowganda has just completed a shipment of a high grade car of concentrates. This car will run to about 25 tons of 2,500-ounce ore.

Ore shipments for the month of September were about 400 tons higher than for the previous month. This is almost entirely due to the shipments from the Buffalo mine. This property has been shipping out a large tonnage of low grade concentrates which formerly would have been treated by the cyanide mill.

PORCUPINE, KIRKLAND LAKE AND MUNRO TOWNSHIP

Refining of Gold.—It is a remarkable fact that while nearly $800,000 in gold is being shipped every month from the Porcupine camp, none of this is being treated at the Ottawa Mint where it was stated semi-officially that the new refinery has been completed and can now handle raw bullion. Careful inquiry elicited the fact that no very strenuous effort had been made by the Ottawa mint officials to obtain the Porcupine bullion for treatment and that returns on which such bullion can be taken and treated at Ottawa were such as no business men would care to consider. The Hollinger ship to New York and many of the other companies to Denver, where very prompt and fair settlement is made for gold. Settlement from Denver is made about twelve days after the bullion has been shipped express. In New York the company is credited with the amount of the shipment about seven days after it has been shipped. The advantage of the refining of the gold in Canada appears so obvious that it is a subject of comment that no effort is being made to keep it in the country and not to ship it to United States mints and refineries.

Recruiting.—Very remarkable success has attended the efforts of the recruiting officers of the Pioneer Regiment in Northern Ontario. It was particularly so in Timmins where Lieut. Smith recruited over 100 men. The calibre of these recruits is excellent. Four or five of the hundred were graduated mining engineers and the great majority were miners and prospectors of some experience. There were but a mere handful that described themselves as having no technical knowledge of some trade or profession. The results obtained can be attributed very largely to the Hollinger mine officials and particularly Mr. A. R. Globe. Mr. Globe is a South African veteran and for the past two months he has been conducting what is really a training corps. Nearly all the men in this training corps joined the Pioneers and their example was so infectious that it was specially difficult to keep any of their friends. There was hardly a mine staff in Porcupine that did not lose one of its good men and the Hollinger staff is very much depleted. Considerable effort and considerable encouragement to recruiting was shown in the Porcupine camp and every mine manager in the camp agreed that he would take back any man that went with the Pioneers if they returned and desired to take up their old positions. The Hollinger went still further and declared that the loyal

service bonus would be continued as if the man had not left the country provided they came back to the Hollinger staff. This appeared to be a very great encouragement to the men who desired to go to the front. In addition recruiting meetings were held in Timmins, South Porcupine, Cochrane and Matheson, and everywhere met with great results. Capt. Allan will be in charge of the detachment from Northern Ontario and with him will be Lieuts. Smith and Tait, who have been recruiting in Timmins and Haileybury, respectively. It was the intention to raise 250 in the district between the National Transcontinental and the C.P.R., but it does not seem unlikely that the total number will be raised from the Timiskaming district alone. The men from the Porcupine district have been brought down to Haileybury, but expect to be moved very shortly to London, where mobilization will be completed. One of the inducements held out to recruits was that the need of the corps would not necessitate very long training and that they would be likely to get to the front in a very much shorter time than the regular infantry. A recruiting office has been opened in Cobalt. Capt. R. P. Rogers has just been placed in command of a detachment of the Royal Engineers. This Canadian detachment will be known as No. 1 Tunneling Company, C.E.F. It will be attached to the Royal Engineers and is an Imperial command. Mr. S. M. Thorne has been appointed recruiting agent and Mr. McMillan, Assistant Mining Inspector, will also take a commission in the same company.

Jupiter and McIntyre.—After many months of negotiations with various companies the Jupiter Mining Co. has decided to accept the offer of the McIntyre Porcupine Mining Co. for the sale of the control of the former company. The McIntyre has agreed to at once pay off the debts of the Jupiter, which now amount to about $60,000. The remaining $92,000 will be disbursed at the rate of $5,000 a month in the development of the Jupiter property. A new company will be formed which will probably be called the Jupiter Porcupine or a variation on the old name, and for their outlay the McIntyre will get control of this company. Once the outlay has been ratified by the shareholders' meeting on October 29th, preparations will be made to expedite the centralization of operations at the Pearl Lake shaft. It is proposed that the Pearl Lake shaft shall be the central hoisting shaft on the north side of the McIntyre property. The McIntyre is already mining remarkable ore along what is known as the contact zone. This zone runs across the corner of the Pearl Lake property and can be traced for 2,500 feet on the Jupiter. The McIntyre directorate believe that prospects are good of obtaining fine results on the Jupiter although assays are low on the surface, but so they were on the surface at the McIntyre. On the same vein system until such time as it is possible to make connections between the old workings and the Jupiter and Pearl Lake shaft under ground, the ore will be mined and drawn across to the McIntyre mill where an extension is already being prepared for its reception and treatment. An ore bin will be provided at the old Jupiter workings, from which the big wagons will be filled and the ore will be dumped down this and afterwards drawn out from that point. As the main Jupiter orebody is likely to be an extension of the McIntyre no serious metallurgical difficulties are anticipated in the treatment of the ore and the unit to be established will correspond very closely to that already installed at the mill. This unit it is expected will be ready by January 1st, at which date there should also be a considerable tonnage of ore broken at the mine.

Power at Porcupine.—An engineer on the staff of the Hydro-Electric Commission has recently been making an investigation into the power situation in Porcupine. The rate charged by the Northern Canada Power Co. varies very considerably, and it was desired to see what can be done to adjust the rates. In many of the smaller plants in Porcupine the cost per ton in power is a very prominent factor. Some of the companies are running half Hydro-Electric and half steam power; not because they desired it, but because the demand on the power in the camp usually exceeds the supply. This is not the case now because of the unusually wet season and it is probable that enough power will be available to safeguard them for the ensuing spring, but the increasing demands of the Dome and the Hollinger alone will make absolutely necessary the obtaining of more power. The present power company expresses its intention of obtaining more power by conserving the water flow on the Mattagami river.

NEWFOUNDLAND

Mr. J. J. McDougall, C.E., manager of the Dominion mine at Bell island, who returned recently from a visit to Sydney, brings the pleasing news that his company will operate on a specially large scale the coming winter at Wabana, working all the areas now opened and employing 1,000 men or more all through the winter months. The output will be stocked as removed from the mine, and held until the spring and then a large fleet of steamers will be employed to convey it to Sydney, where smelting operations on a large scale will be carried out as a result of the increase of iron and steel production due to the extensive manufacture of war munitions throughout Canada.

Report has it that the "Workington" iron mine in the district of Bay-de-Verde, which has lain idle for fifteen years, is to be re-opened in the early spring by a large and wealthy corporation. The property is owned by the Newfoundland Iron Ore Co., Ltd., and from 1897 to 1900 this property was looked upon to outrival the famous iron deposits of Bell island. Many shafts from 40 to 300 feet in depth were sunk on the property, and several hundred tons of ore was raised to the surface. At 150 feet in depth it was said that one-half million tons of ore was in sight.

The Newfoundland company spent considerable sums of money on the work. They erected a very costly plant at the workings, built seven miles of railroad from Old Perlican, which was to be the shipping port, and constructed a substantial loading wharf, besides building several houses for the workingmen. Why this mine was closed has never been known. Not only was it closed, but the plant and railway track with engines were all removed. The ore from this mine is a red hematite, of a higher grade than Bell island, averaging over 60 per cent. in metallic iron and freer from injurious ingredients such as sulphur and phosphorus.

The success of the British Empire and her Allies in the wars now raging to a large extent depends upon an adequate supply of iron and steel and other finer metals, and it should be the duty of all who desire the old Flag still to wave above us, to see that there shall be an unlimited and constant supply of the raw material for all purposes. Newfoundland is indeed rich in iron, copper, lead, manganese and sulphur ores and other minerals, and that her sons are patriotic enough to work day and night in the mines, to supply the fur-

naces of Canada and England with material for shells and guns, there is not the least doubt.

In addition to vast supplies of hematite ore, Newfoundland and Labrador possess vast deposits of magnetic ore, which up to the present has not been utilized. The recent favorable results attained in electric smelting may lead to solving the problem of satisfactorily reducing the class of ores which under the old methods of smelting baffled all the efforts of metallurgists. Should a satisfactory process evolve, it is certain that Newfoundland and Labrador will eventually become one of the largest iron ore centres in the British Empire.

A cargo of copper ore has just been shipped from the Tilt Cove mine; this is the second cargo this week. The discovery of Tilt Cove copper mine dates back to about 1857. Since 1864 work has been carried on uninterruptedly, and it is pleasing to know that after fifty years of mining and shipping, during which time many million pounds of copper were exported, the property gives no evidence of decay to-day. The property was originally owned by Messrs. C. F. Bennett and Smith McKay, two of Newfoundland's respected merchants, who, up until 1888, operated the property with a great measure of success. In 1888 the mine was leased to the Tilt Cove Copper Co., Ltd., whose capitalization was £20,000, with head offices at 9 Queen Street, London, and with John Taylor & Sons, managers, and Col. J. W. Young, chairman. The annual rental paid the owners was £4,400 and one-half of the net profits earned.

BRITISH COLUMBIA

While still early to estimate what will be the total value of the mineral production of British Columbia in 1915, there seems to be good reason for thinking that it will, on the whole, compare favorably with that of last year. This statement is made assuming that nothing will happen to seriously affect the output of ore and coal during the last quarter of the year. In regard to the latter, cheering accounts have come in, these indicating that the demand for coal is gradually increasing as the winter season approaches. The output of lode metals seems to be fairly well maintained, with a tendency toward larger production of both copper and lead than during the earlier part of the year. It is probable that the production of silver will be somewhat less than that of 1914, and zinc production, too, has been smaller owing to market conditions not having been good. Yet, taking things all round, there is no good reason to think that the total value of this year's mineral production will be as low as that of last year.

East Kootenay

Coal mining has been fairly active lately at both the Coal Creek and Michel collieries of the Crow's Nest Coal Co., and it is known that the outlook for an increased demand is promising. Development of extensions of known coal areas of the fields in which are situated the mines of the two collieries above-mentioned can easily be undertaken whenever a market shall be found for a much larger output of coal than has been made during the last year or two. A gratifying feature is that big deposits of coal of excellent quality have been opened by recent developments, and as progress is made with further development and equipment of several new mines, the large productive capabilities of these properties become more evident. With much coal of good quality available for making coke, it follows that a corresponding improvement in the quality of the coke produced results. There is a larger market for coke now than during the last quarter of 1914, for with smelting works again in operation at Grand Forks and Greenwood, in the Boundary district, and the smeltery at Trail, in West Kootenay, treating more ore now than last autumn, the total quantity of coke used monthly at those several works is necessarily greater than when less ore was being smelted at them. In addition, Crowsnest coke is in demand for use at some of the Montana smelteries.

Some information was supplied recently relative to copper properties situated in Fort Steele mining division. Much interest is also being taken locally in gold claims in the neighborhood of Perry creek, which flows into St. Mary's river between Marysville and the junction of the river with the Kootenay at Fort Steele. Some of the lodes or veins on Perry creek are continuous for miles, generally without break or fault. The value they contain is in gold. Chief among the properties that have attracted attention is the Homestake group of ten claims, on which Mr. Geo. T. Carr has done work for seven or eight years. With Mr. Carr is associated in the ownership Mr. Wm. Duff Hanie, of Chicago, Illinois, who last year had a number of samples of the ore from this group assayed in Chicago, with the result that assay returns up to $19.20 a ton in gold were obtained, while the result of assay of an average sample over a width of 28 feet was given as having been at the rate of $9.60 a ton. The development work done on this group includes two shafts, each sunk to a depth of 60 feet, and a crosscut adit driven 400 feet to the vein with drifts 170 feet in one direction and 120 feet in the other. In addition, there has been much opencut work done on the various claims of the group. An idea of the renewed interest taken in the Perry Creek region when the results of Messrs. Carr and Hanie's assay tests were made public may be obtained from the authentic statement that more than 200 mineral claims have been located in the neighborhood and recorded at the office of the mining recorder at Cranbrook.

Metalliferous minerals produced in quantity in Fort Steele division over many years include gold, silver and lead. The St. Eugene mine, near Moyie, was long the chief lead-producing mine in Canada; now the Sullivan, near Kimberley, holds that distinction. The North Star, also near Kimberley, was at one time a well-known producer of ore, the chief valuable constituent of which was silver, with lead a less important content. There are great masses of lead-zinc ore in the neighborhood of Kimberley, but much of it is of a complex character not amenable to ordinary reduction processes. Another mineral, recently discovered in the St. Mary's region is molybdenite, samples of ore found on Baker creek, a tributary of St. Mary's river, having been sent to Victoria for identification and there determined to contain molybdenum.

The Florence Mining Co.'s mine, situated about two miles from Ainsworth, will shortly concentrate its ore at the Highland mill under an arrangement with the Consolidated Mining and Smelting Co., which has not for several months used the plant to concentrate ores from its own mines in the neighborhood of Ainsworth. A report is current that another good shoot of ore has been opened in the Highland mine.

MARKETS

STOCK QUOTATIONS.

October 25, 1915.

New York Curb.

	Bid.	Asked.
Alaska Jun Gold	11¾	12
Braden Copper	9½	9⅝
Chile Copper	23	23¼
Kennecott Copper	53¾	54
Magma Copper	14¼	14½
Nipissing Mines	6¾	7
Tonopah Extension	2¾	3
Tonopah Mining	5⅜	5½
Yukon Gold	2¼	2½

Cobalt Stocks.

October 26, 1915.

	Asked.	Bid.
Bailey	4⅜	4⅛
Beaver Con.	30	29
Buffalo	65	45
Chambers Ferland	15	13½
Coniagas	380	350
Crown Reserve	42	41
Foster	..	3
Gifford	..	1½
Gould	⅞	½
Great Northern	3	2½
Hargraves	2	1¼
Hudson Bay	2200	2100
Kerr Lake	..	350
La Rose	50	45
McKinley Darragh	31	29
Nipissing	690	680
Ophir	2	1
Peterson Lake	22½	22¼
Right of Way	4¼	..
Seneca Superior	65	60
Silver Leaf	2	1⅞
Timiskaming	42½	42¼
Trethewey	18	15
Wettlaufer	7	6
York Ont.	2	1

Porcupine Stocks.

October 26, 1915.

	Asked.	Bid.
Apex	3¼	3
Dome Extension	27½	27
Dome Lake	20	19
Dome Mines	3000	2600
Eldorado	½	⅛
Foley O'Brien	..	40
Gold Reef	4	3
Homestake	..	16
Hollinger	..	2490
Jupiter	11½	11¼
McIntyre	53½	53
Moneta	7¼	7
Pearl Lake	⅜	..
Porcupine Crown	..	79
Porcupine Gold ex-r	½	..
Porcupine Imperial	5¾	5½
Porcupine Tisdale	1¼	1
Porcupine Vipond	84	83½
Preston E. D.	6¼	6⅛
Teck-Hughes	10	9
West Dome	9¾	9⅝

SILVER PRICES.

	New York. cents.	London. pence.
October—		
9	49½	23⅞
11	49½	23⅞
12	..	24
13	49½	24
14	49⅝	24
15	49⅝	24
16	49⅜	23⅞
18	49⅝	23⅞
19	49⅝	23⅞
20	49⅜	23⅞
21	49	23¾
22	49	23⅞
23	48⅞	23⅞
25	48⅞	23⅞

TORONTO MARKETS.

Oct. 27, 1915—(Quotations from Canada Metal Co., Toronto)
- Spelter, 18 cents per lb.
- Lead, 6½ cents per lb.
- Tin, 37 cents per lb.
- Antimony, 40 cents per lb.
- Copper castings, 19 cents per lb.
- Electrolytic, 19 cents per lb.
- Ingot brass, yellow, 13c.; red, 15 cents per lb.

Oct. 27, 1915—(Quotations from Elias Rogers Co., Toronto)
- Coal, anthraçite, $7.75 per ton.
- Coal, bituminous, $5.25 per ton.

NEW YORK MARKETS.

Oct. 22, 1915—Connellsville coke (f.o.b.) ovens—
- Furnace coke, prompt, $2.40 per ton.
- Foundry coke, prompt, $2.60 to $2.75 per ton.

Oct. 22, 1915—Tin Straits, 33.50 cents.
- Copper, Prime Lake, 17.75 to 18.00 cents.
- Electrolytic copper, 17.50 to 17.75 cents.
- Copper wire, base, 19.00 to 19.25 cents.
- Lead, $4.75 cents.
- Spelter, 14.12½ to 14.37½ cents.
- Sheet zinc (f.o.b. smelter), 16.00 cents.
- Aluminum, 54.00 to 56.00 cents.
- Platinum, soft, $50.00 to $54.00 per ounce.
- Platinum, hard, $54.00 to $58.00 per ounce.
- Quicksilver, $92.00 to $94.00 per 75-lb. flask.

CONSOLIDATED SMELTERS.

Consolidated Smelters' pronounced advance, which has been carried 50 points beyond the year's low levels, at this week's best prices, revives rumors that the stock will go on the 10 per cent. basis for which the Street has been looking. All the reports on the company's position for some weeks have been extremely optimistic. Whether or no directors take early action on the dividend it is considered by many that the present earning power of the company gives the stock the increased value. It is interesting to recall that the C.P.R. is a heavy holder of the company's stock; sufficient to bring in a yearly income of $209,520 in the past year.—Financial Times.

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

Ontario
Cohen, S. W.
Campbell & Deyell.
Carter, W. E. H.
Ferrier, W. F.
Forbes, D. L. H.
Gwillim, J. C.
Hassan, A. A.
Haultain, H. E. T.
Segsworth, Walter E.
Smith, Alex H.
Smith, Sydney.
Maurice W. Summerhayes.
Tyrrell, J. B.

Quebec
Burchell, Geo. B.
Cohen, S. W.
DePencier, H. P.
Hardman, J. E.
Hersey, Milton L.
Johnson, W. S.
Smith, W. H.

British Columbia
Brown & Butters.
Fowler, S. S.

FOREIGN-New York
Canadian Mining & Exploration Co., Ltd.
Colvocoresses, Geo. M.
Dorr, Jno. V.N.
Hassan, A. A.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

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BROWN & BUTTERS
Mining Geologists and Metallurgical Engineers
PRINCE RUPERT, B.C.

BURCHELL, GEO. B.
Mining Engineer
Lignite and Bituminous Coal Mining
Examinations and Reports
505 McGILL BLDG., MONTREAL
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Mining Properties Purchased or Financed
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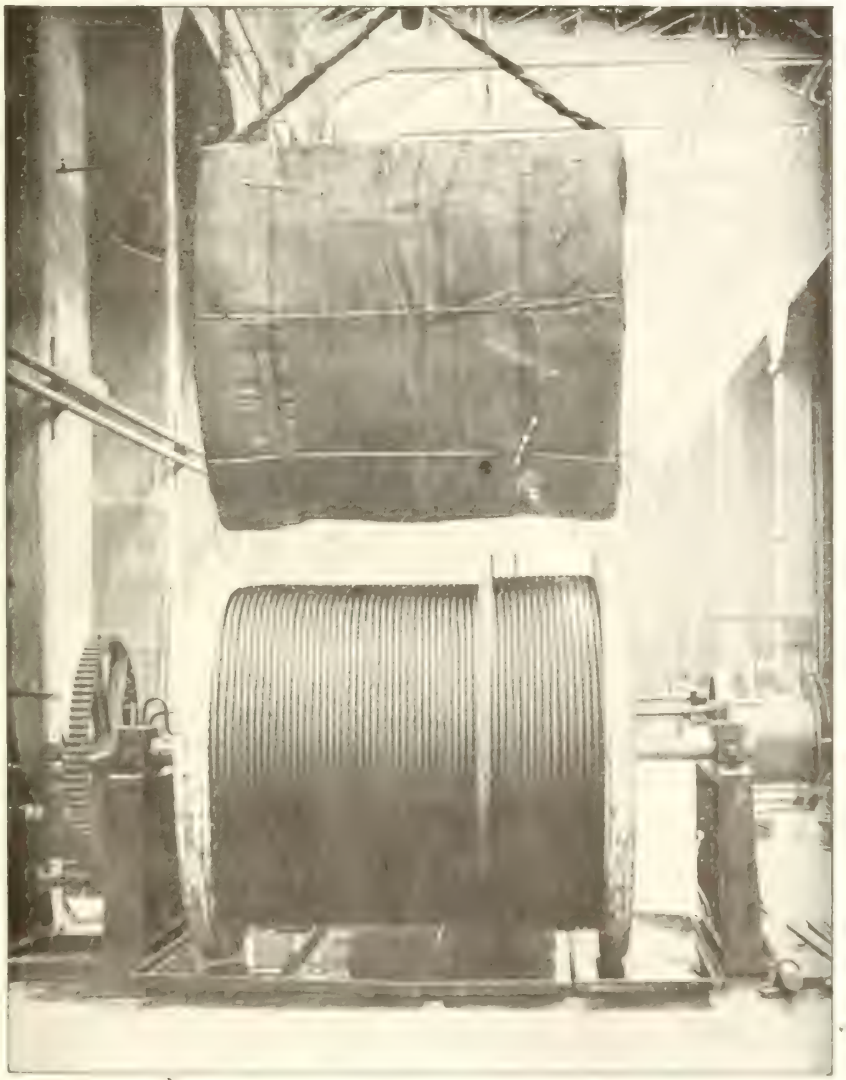

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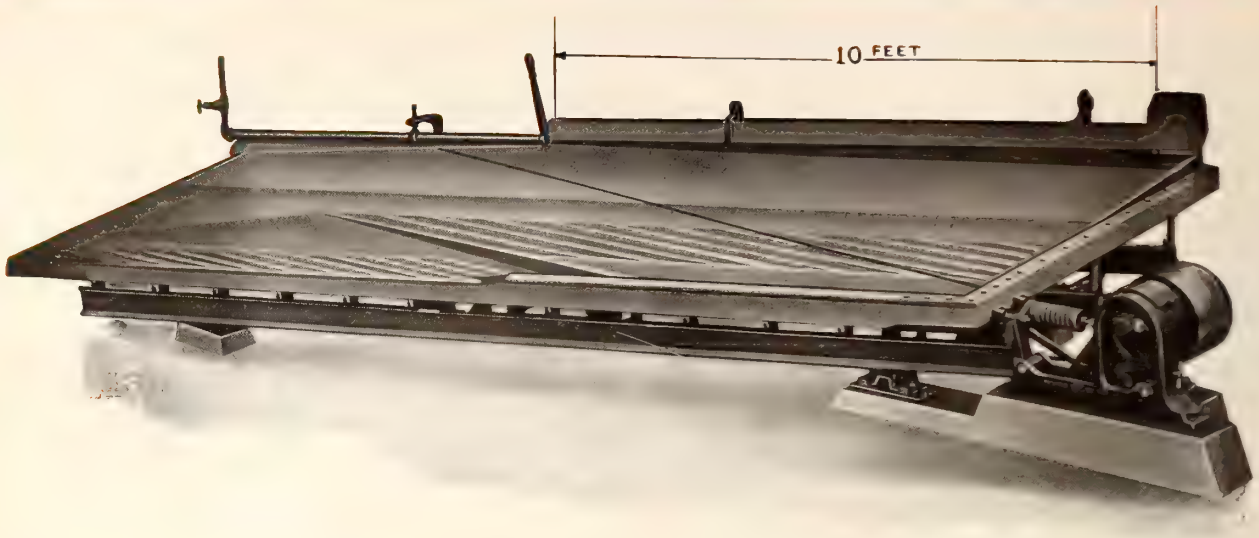

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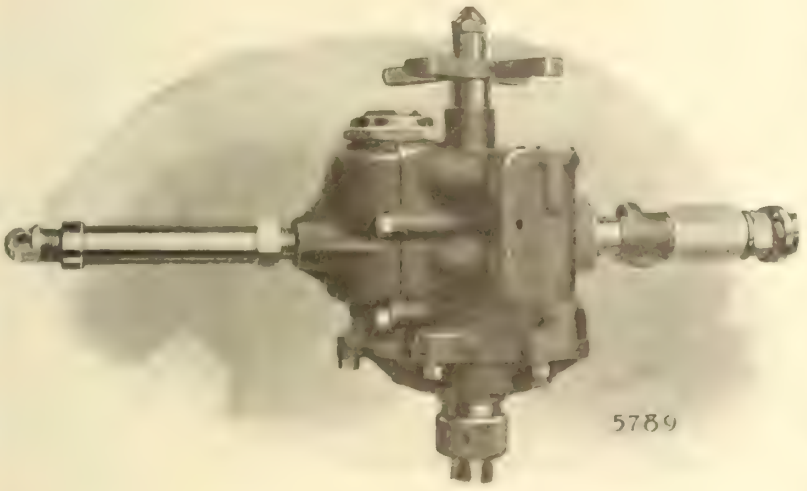

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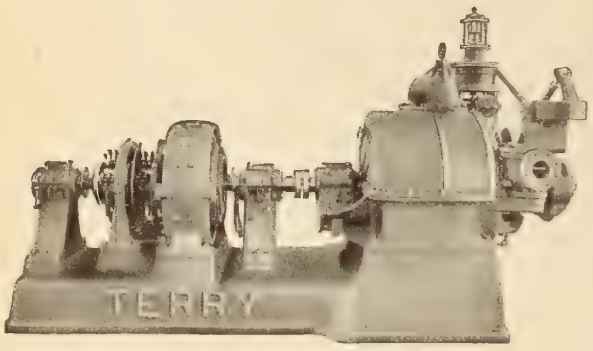

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In surveyed territory the land must be described by sections, or legal sub-divisions of sections, and in unsurveyed territory the tract applied for shall be staked out by the applicant himself.

Each application must be accompanied by a fee of $5 which will be refunded if the rights applied for are not available, but not otherwise. A royalty shall be paid on the merchantable output of the mine at the rate of five cents per ton.

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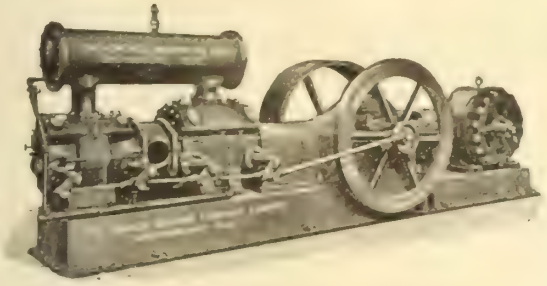

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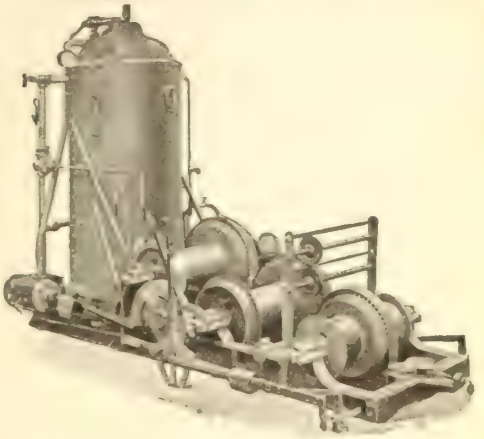

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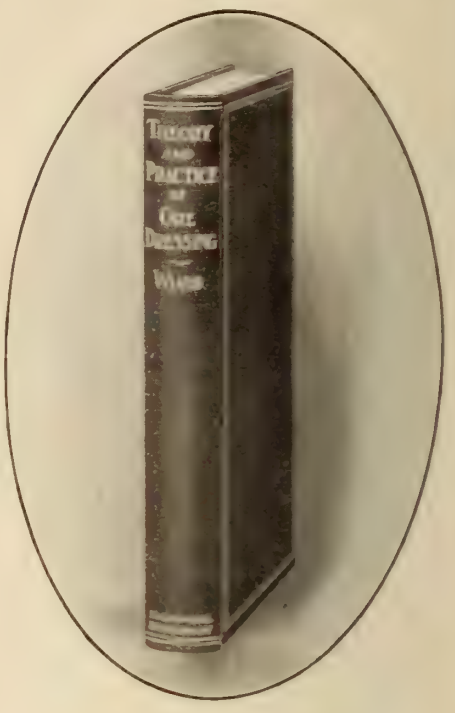

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I. Preliminary considerations, Relating to Installation of Ore-dressing Plants. II. Testing Concentrating Ores. III. Location of Mills. IV. Crushing Plant. V. Separating Plant. VI. General Dissertation on Crushing, Heavy Crushing Machinery. VII. Rolls and Medium Crushers. VIII. Means for Raising Ore or Ore and Water. IX. Grading and Grading Devices According to Diameter and Volume. X. Separation or Concentration Proper, Coarse Separation. XI. Preparation for Sand and Slime Concentration. XII. Miscellaneous Processes of Sand and Slime Concentration.

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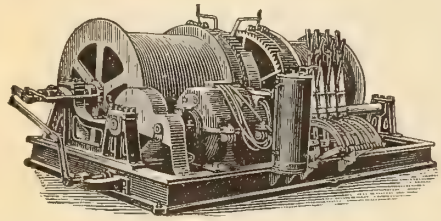

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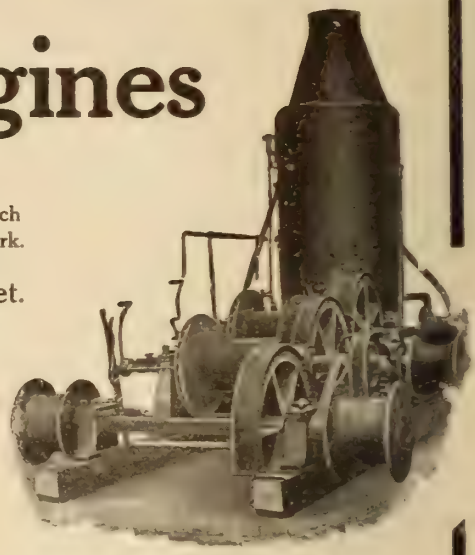

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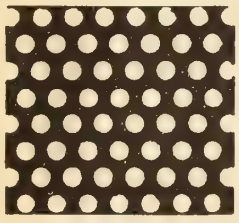

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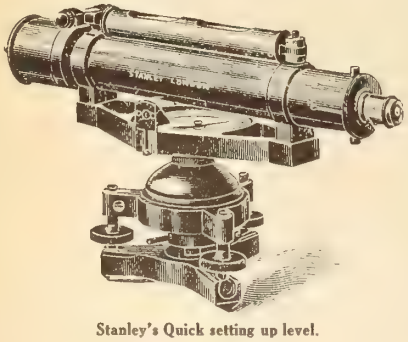

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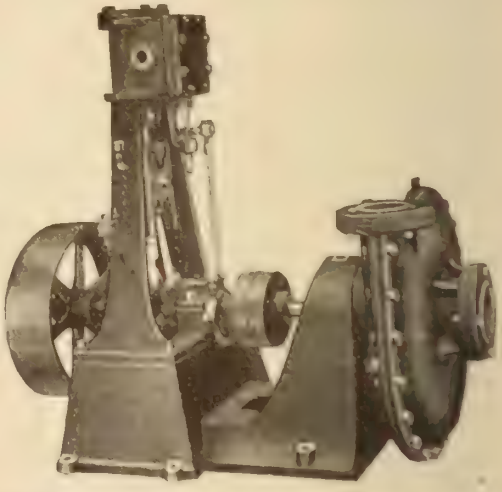

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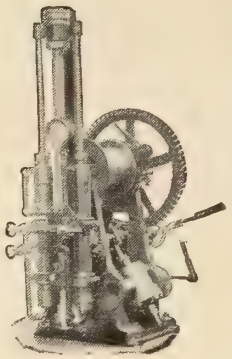

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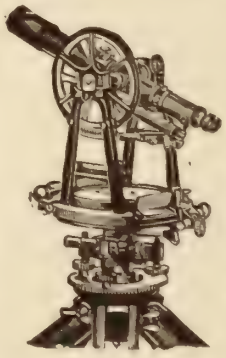

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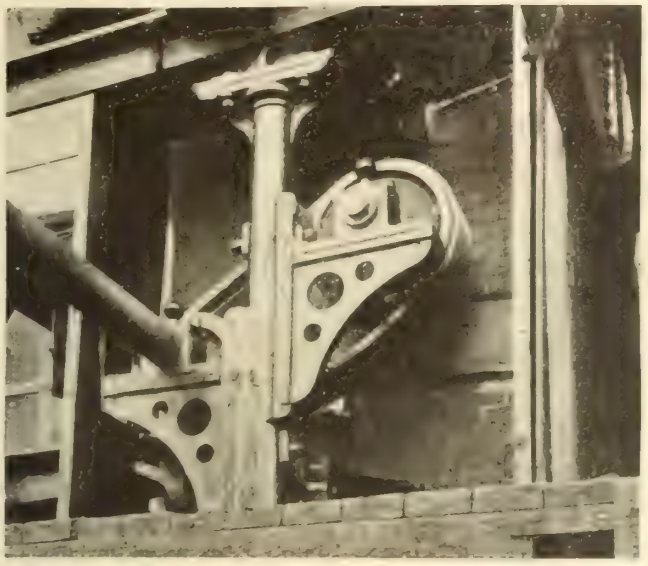

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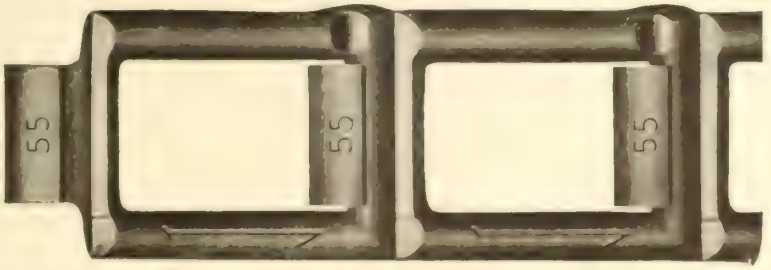

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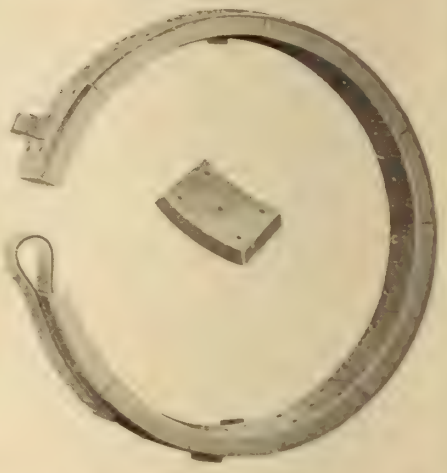

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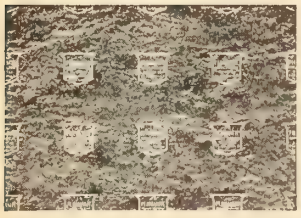

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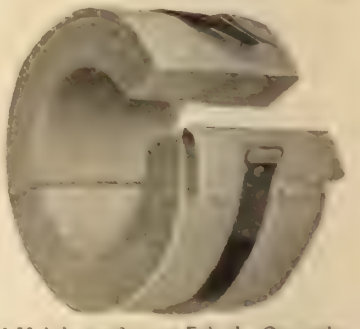

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THE CANADIAN MINING JOURNAL

VOL. XXXVI. TORONTO, November 15, 1915. No. 22

The Canadian Mining Journal

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"CANADIAN MINING REVIEW"

Devoted to Mining, Metallurgy and Allied Industries in Canada.

Published fortnightly by the

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Editor

REGINALD E. HORE

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CIRCULATION

"Entered as second-class matter April 23rd, 1908, at the post office at Buffalo, N.Y., under the Act of Congress of March 3rd, 1879."

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COLLEGE EDUCATION OF MINING ENGINEERS

Mining is one of Canada's greatest industries. We might therefore expect that the education of men to take charge of and operate mines would be an important feature of our educational system. Is it?

Professor J. C. Gwillim of the School of Mining, Kingston, in a contribution to the November bulletin of the Canadian Mining Institute states that the number of students in mining in Canadian colleges is very small, and he points out some of the reasons. One of these is the standard of admission, which, however well it may meet the requirements of other professions, is likely to prove a bar to the young men who are most familiar with and are most interested in mining owing to their living in mining districts.

It is quite evident that in drafting requirements for admission to Canadian Universities the profession of mining engineering has been either ignored or misunderstood. Those who have the best interests of the profession at heart will read with interest Professor Gwillim's letter.

In order to bring about any important change we must know the opinions of many members of the profession.

It is not a difficulty with which the professors of mining at the several colleges should be left to struggle alone. They recognize the unsuitability of the present requirements for admission, but they have not themselves the power of changing them. If men who have taken the mining courses in Canadian Universities can be prevailed upon to give their opinions of such courses, and if men who would like to take such courses but are not allowed to do so because of inability to pass examinations in subjects in which they are not interested will make their desires known, steps can be taken to bring the matter before the proper authorities. We hope to see further discussion of the subject in future editions of the Bulletin of the Institute. We will be pleased also to publish in the "Canadian Mining Journal" the views of any who are interested in the subject. It would be especially useful if young men who are prevented from availing themselves of college training by inability to pass the present admission examinations would state their case. Mining men who have such ambitious men in their employ can help them by urging them to write or by stating the case for them. To get what we want we must know what we want. We must have clearly in view the chief difficulties to be encountered.

The price of silver has been a little higher recently and is encouraging producers in their hopes of a better market in 1916.

PRACTICAL MINING FOR MINING ENGINEERS

It has been a very common practice in Canada to urge graduates in mining engineering to forget the fact that they are graduates and to go to one of the mining camps and take employment as unskilled laborers. They are advised that they cannot hope to be successful unless they spend a few months shoveling broken rock into tramcars. When they have done this they are supposed to be better able to appreciate how much inferior they are to the average laborer. They are then to approach the superintendent and ask to be given some other kind of work, anything being preferable to "mucking". Then after spending a few weeks dragging logs up into stopes for the timbermen, carrying steel for the machine runners, or helping disabled tramcars back onto the track, they may be given jobs as helpers on drills. After a period as helpers they may be allowed to run the machine themselves. Then while the miners take their places as helpers, they may place or misplace a few holes themselves. The attempt at placing the holes is not unlikely to meet with the disapproval of the miners and to lower the latter's opinion of college graduates to the level of the sump, if it is not there already. In case one-man drills are used the college graduates may be put in working places by themselves, but in this case the proper amount of criticism is not obtained, being limited to the lunch hour visits of the nearby workers. A greater variety of holes is often obtained in this way however as the restraining influence of a partner who does not like to see work wasted is lacking.

There is good reason for advising college graduates to gain some experience at the work of the various employees of a mining company. This is especially true of the underground work, for nothing is more vital to the successful operation of a mine than a very intimate knowledge of what is going on below the surface. It is well to impress this fact, for it is sometines lost sight of by others than novices.

But should experience in the work of underground laborers be sought after graduating from college? Is it not better to do such work at an earlier stage? We agree with Professor Gwillim when he says: "practical mining should be seen and known before entering and during college years, not learnt at a rock pile or roast heap after one's brains have been trained to do better work."

The time honored custom of advising graduates to spend a period as laborers doubtless arose from the fact that Canadian mining colleges are not located in mining districts. It was not impossible a few years ago for a student to graduate from a mining course without having had any experience in a mine. Those who lived in mining districts or who found employment in mines during vacations were prepared for more important tasks, but those who neither lived in nor visited the mining districts had to learn a great deal about mining that is not taught in colleges. The difficulty has been partially overcome by refusing to grant degrees to students who have not worked for a certain period in mines or metallurgical plants.

It is not essential to the success of a mining engineer that he should be able to shovel as much broken rock per day as does a common laborer, be able to drill as many holes per day as the average miner, slide ladders as quickly as the drill boy, sharpen drills as well as does the blacksmith, nor even to understand foreigners as well as does the mine captain; but it is essential that he should have an intimate knowledge of what the various employees are doing and what they are capable of doing. A little time spent at each of the underground tasks should prove useful in later years to any engineer.

SERVIAN COPPER

The newspapers recently printed a despatch describing the Servian copper mines captured by the Germans as "probably the best copper mines in Europe." There is one important copper mine in Servia, the Bor, which produced in 1912, 16,500,000 pounds copper. Such a production is exceeded by only a few mines in Europe. In 1912 Europe's premier copper mine, the Rio Tinto, Spain, produced 89,432,000 pounds, the Mansfield, Germany, 45,200,913 pounds and the Kyshtim, Russia, 16,812,000 pounds.

The Bor mine ranks fourth among European copper mines in production and is a prize of very considerable value to the Germans. Aside from the Bor there are no important producers of copper in Servia.

In 1912 the copper production of Germany was 53,581,500 pounds, and of Austria-Hungary 8,820,000 pounds. The Bor mine production is therefore equal under normal conditions to about one quarter the combined output of the central powers.

It would be folly to suppose that the Bor mine was left in working condition by the Servians. It was doubtless, as has been reported, flooded and the machinery destroyed. The Huns will of course make heroic efforts to get it into operation quickly; but it may easily be at least a few months before the mine is again making a large production.

The Glace Bay collieries of the Dominion Coal Company produced 408,200 tons in October, an increase of 40,184 tons over 1914. The coal and steel industries of Nova Scotia have made a grand recovery from the depression which followed the outbreak of war. The closing months of this year will probably be very busy ones.

Few companies can show a better record of enlistments for military service in this war than the Dominion Coal Company. Nearly 1,500 men, most of whom had worked underground, have gone to the front from the Glace Bay mines, or are on the way. These men should prove specially useful in tunneling operations and their services are doubtless being turned to good account. The loss of so many good miners must seriously embarrass the mine operators.

The Orillia Molybdenum Company announces that its concentration process has worked out satisfactorily. The company is now making weekly shipments of concentrate to the Imperial Government brokers at Liverpool, and is in the market for molybdenite ores.

NEUTRAL RIGHTS

In the recent note to Great Britain, Secretary Lansing says that the United States "unhesitatingly assumes the task of championing the integrity of neutral rights." Maybe the people of Belgium will derive some comfort from that statement. Possibly however they prefer the aid given them by Americans through the Belgium Relief Commission to that which they can find in the American note. Possibly also they are convinced that the champion of neutral rights is now fighting for them and has been fighting for them since the Huns invaded Belgium.

We are advised that membership in the International Engineering Congress will be open until the close of the year. Members will receive copies of the transactions on the subject they are most interested in. The Secretary calls special attention to the great value of the papers on the Panama Canal. In the mining and metallurgical sections several important papers were presented.

The Porcupine district has now to its credit another gold producing mine, the Schumacher. The Schumacher property has been developed by Mr. F. W. Schumacher and his associates in a somewhat leisurely manner and without attracting much public attention. Mr. Jos. Houston, the superintendent, has carried on development as extensively as a very limited monthly expenditure would allow. A mill has recently been built and began treating ore in September. The October production is reported at $20,000.

It is with regret that we notice the conclusion of the long and honorable career of the "Colliery Engineer," a periodical that is perhaps better known to the present generation of mining men under the name of "Mines & Minerals." The "Colliery Engineer" has been purchased by the publishers of "Coal Age," and the two papers consolidated. It is a sign of the times and of the far-reaching influence of the metropolis of New York. The "Colliery Engineer" was above all a students' paper, and its history has been largely bound up with that of the International Correspondence Schools of Scranton. It may be presumed that the unfortunate position of the I. C. S. brought about by a departure from its legitimate activities has had something to do with the sale of the "Colliery Engineer." However this may be, there is a large circle of readers that will miss the more scholastic and literary *format* of the older periodical, and will not find in the up-to-date and somewhat commercialized characteristics of "Coal Age" the same sense of interest and familiarity they used to feel towards the "Colliery Engineer." F. W. G.

Iron and steel are in great demand both for war purposes and for domestic purposes. The output of the market during the past few months has been wonderful. It is comparable with the great improvement which in the case of nickel, copper, lead, zinc and minor metals showed itself early in the year.

Copper production of the Granby Consolidated Mining Smelting and Power Co., British Columbia's premier copper mining company, is reported to have been 4,119,389 pounds last month. This is a new high record.

Increase in wages has been announced by the nickel-copper mining companies of the Sudbury district. The companies are doing an exceptionally large and profitable business this year and it is only fair that the employees should not be forgotten.

Messrs. Davis and Steindler, who purchased the Dobie-Leyson claims in Munro township have named their company the Croesus. If such ore as has been mined in development work is found in large quantity the mine will prove to be very well named.

The paying of a dividend of over $65,000 by the Tough-Oakes mining company will probably help to attract to Kirkland lake and other districts along the Temiskaming and Northern Ontario Railway some of the attention which the numerous promising gold discoveries deserve.

Pacaud township seems destined to be included among Ontario gold producing areas. A discovery made by J. Macdonough early in the fall has been found very promising and it is said that development work will be started at an early date.

POTASH FROM FELDSPAR

Several new methods of increasing the supply of American potash have recently been brought to the attention of the U. S. bureau of foreign and domestic commerce, of the department of commerce. One of the most promising is a patent taken out a few weeks ago by a Canadian for a method of using the potash in ordinary feldspar.

The process is simple, consisting of heating the feldspar with limestone and iron oxide at a temperature of about 2,200 degrees Fahrenheit, which produces a partly fused mass that is easily decomposed by a weak acid. From this product the potash salts can readily be extracted for further purification. It seems very possible that a greatly simplified method of transforming feldspar into fertilizer will soon be available.

A practical try-out for another method will soon take place at a New Orleans distillery where molasses is used in large quantities. It is a fact that 100 tons of potash are wasted daily by the 25 or more distilleries in this country that subject molasses to processes of fermentation. The New Orleans company is planning to install the process of saving the potash in distillery waste recently brought to the attention of the public by the bureau of foreign and domestic commerce. It should be possible to make fertilizer from this otherwise worthless material at a price that will meet competition even after the war is over.

SEPARATION OF COPPER AND NICKEL

Mr. N. A. Hultgren of Houghton, Mich., has patented a process for separating copper from copper-nickel solutions by using as anode a compound containing [illegible]. The anode is [illegible] corroded in an electrolytic bath.

National Lead Co., Trenton, N. J., has assigned the application for this patent in the United States.

Experimental pavement at Edmonton, laid under direction of S. V. Ells, of the Mines Branch, to demonstrate use of Alberta's bituminous sand deposits.

ELECTRIC FURNACES FOR HIGH TEMPERATURE WORK*

By F. T. Snyder

Substantially all industrial chemical reactions are conditioned and limited by the factor of time. Time stands for interest on investment, the wages of workers and the counterbalanced factors of quantity of output and quality of product. The speed of most chemical reactions increases rapidly with temperature. If conditions are such as to permit a reaction being carried on at a higher temperature, the time factors, interest and wages, may be greatly reduced. In a case recently investigated, the projected plant investment was reduced by two-thirds by changing the reaction from one in aqueous solution to the corresponding reactions in fusion. There are, however, various commercial limitations to this easy way of cutting costs. The temperature may not be raised above the point that injures the product. Frequently more important, from a time standpoint, is the fact that the same rise in temperature that speeds the original and desired reaction, also speeds the reverse reaction. When two elements or compounds react to form a product which is not removed, this product begins to break up again into its originating parts at a speed which is usually as sensitive to rise of temperature as the original reaction. In addition, as more and more of the product is formed, more is available to break up, until eventually the speed of the reverse reaction catches up with the original reactions, and an apparently static condition exists with both elements and products present in equilibrium.

While this static condition always eventually occurs as the result of the law of mass action, the percentage of product in the equilibrium conditions is conditioned by the relative temperature law of the elements and of the product or products. If a high temperature speeds the breakup of the product less than it does the original reaction, increasing the temperature of operation will help the commercial factors of time. In many reactions rise of temperature so speeds the reverse breakup of the product, that little or no commercial gain is to be obtained by higher operating temperatures.

If the speeds of various related reactions be plotted as lines against varying temperatures, the results are curves which, in general, are not parallel and consequently cross. This crossing means that reactions which tend to run one way at lower temperatures, may, and frequently do, tend to run the other way at sufficiently higher temperatures. The familiar illustration is that manganese may be burnt out either before or after the carbon in a steel converter, depending upon the temperature of the bath. From this it follows that command of higher temperatures may make some practical reactions that would not occur at commercial speeds at lower temperatures.

Fuel heating itself is the result of one or several chemical reactions, which running to the limits indicated, release a fixed amount of energy. This definite amount of energy can raise the products of combustion to a definite temperature and no further. With direct fuel heating the reaction temperature to which this fuel heat may be applied is necessarily somewhat lower, as part of the temperature has to be used as a thermometric head to transfer the heat from the products of combustion to the reagents of the chemical operation. By heating the fuel and air before combustion, the resulting flame may be carried to higher temperatures, as in the regenerative open hearth. The limit in this case is the destruction temperature of the apparatus for preheating the fuel and air; the checker work of the regenerative chambers. At this place it may be well to point out that the regenerators of an open hearth furnace do not add seriously to the thermal efficiency of the furnace, but only serve to enable a high temperature to be reached. At best the thermal efficiency of even the most modern open hearth is very low. In making steel from hot mixer metal probably 9% is the best published result.

With an electric furnace the heat is obtained by the molecular agitation of a resister, either solid, liquid or gaseous, caused by the passage of an electric current. As now generally understood, this electric current consists of a number of moving electrons. These electrons collide with the molecules of the resister and put the molecules in the condition of violent agitation which is commonly stated as "being hot." No reverse reaction speed is involved, so that there is no limit to the temperature that may be obtained in this way by the passage of an electric current, other than supplying the requisite amount of electrical energy to correspond to the heat radiated or otherwise carried away. It is this fundamental difference between fuel and electric heat, that makes the latter preeminently the agent for high temperature work.

To prevent a commercially prohibitive loss of heat, the material being treated must be surrounded by a container of relatively low thermal conductivity. The inner lining of this container or furnace shell must reach the desired reaction temperature of the charge. The success of any high temperature furnace is today largely a matter of developing and properly using materials for such linings. For temperatures above 2,000° C. such linings are themselves electric furnace products, frequently forced in place in the furnace.

* Extracts from a paper presented before Pittsburg section, American Chemical and Electrochemical Societies.

THE TREATMENT OF MOLYBDENITE ORES

From the results obtained in treating several tons of 2½ per cent. molybdenite ore from the Chisholm mine, Ontario, Mr. George C. Mackenzie, of the Mines Branch, Ottawa, outlines a process for treatment of molybdenite ore, containing other sulphides and mica, etc., as follows:—

Crush to 1 in. Dry in a cylindrical drier which does not allow the furnace gases to come in contact with the ore. Pass dried ore to ½-in. rolls and thence to a Newago screen making over ¼-in. to a picking belt, over ⅛-in. to another picking belt and under ⅛-in. to a Keedy sizer.

The picking belts should be at least 30 ft. long. Boys and girls were found better than men for picking. Men working on 2½ per cent. ore picked 2/3 lb., worth about $1, per hour.

The picking belts carry the ore to ¼-in. rolls. It then passes over a single Newago screen. The material under ⅛-in. goes to a Keedy sizer and over ⅛-in. to ¼-in. rolls. The product is screened again and the oversize returned to rolls.

The ore, finally all under ⅛-in. goes to a Keedy sizer, which is simply a large flour bolter made exceptionally strong for ore sizing. The sizer makes 10 sizes, each of which goes to its own water flotation machine. The dust goes to waste or oil flotation, depending on its content of MoS_2.

Tails from water flotation go to waste. They contain no molybdenite.

Heads, containing 20 to 30 per cent. molybdenite go to a Wilfley roaster, where they are subjected to a slightly oxidizing roast at about 1,000 deg. F. Careful roasting is necessary to obviate any partial oxidation of molybdenite.

The roasted concentrate, which now contains oxidized pyrite and pyrrhotite as well as some mica and gangue, is re-floated on another set of water flotation units. The oxidized sulphides and the major portion of the gangue sinks while the unaltered molybdenite floats. This product is about 80 per cent. molybdenite. A richer concentrate can be obtained by drying and re-floating it.

The tailings from the roasted ore contain some molybdenite. This can be recovered by grinding and oil floating or by drying and returning to the Keedy sizer.

In treating the Chisholm ore 50 per cent. of the molybdenite was recovered by crushing in steps and picking out the coarse flake. Over 50 per cent. of the total molybdenite is recovered from material coarser than 1.6 in.

To test the flotation machine patented by Mr. Henry Wood, of Denver, one of these machines is being installed in the Ottawa testing laboratory to run in competition with the Mines Branch process. Mr. Wood claims that his machine will separate molybdenite from gangue without preliminary sizing, and yield a high grade product, recovering 80 to 90 per cent. of the molybdenite.

Mr. Mackenzie considers the preliminary sizing essential for the making of a high grade product. He thinks that the roasting operation may, however, be dispensed with.

The Market For Molybdenum.

According to Mr. Mackenzie the market for molybdenum is likely to be brisk for the duration of the war owing to the scarcity of tungsten. Molybdenum can be used for many of the purposes for which tungsten has been used.

The British Government have appointed Messrs. H. A. Watson & Co., Liverpool, Eng., as brokers to requisition at a price of 105 shillings, on a basis of 90 per cent. MoS_2 content, all shipments of molybdenite arriving in the United Kingdom.

In molybdenite ores compounds of antimony, bismuth, arsenic and copper are very objectionable and must be removed.

Molybdenite is being used in large amounts in the United States in the manufacture of so-called tungsten lamps.

Molybdenite ore may be exported to the United States for treatment in reduction works provided a guarantee is given for the return of the product to Canada or for re-exportation to the United Kingdom.

THE PRICE OF COPPER

An authority on copper says:

"In spite of the large production which manifested itself for several years prior to the war, it was established that hardly more copper appeared on the market than was actually necessary to supply the needs of the world. In the year 1912 there was an increase in the world's production of 267,000,000 pounds over 1911, and still the average price of copper in 1912 was 16.3 cents per pound and in 1913, 15.2 cents per pound. The average price of copper for the past 30 years has been over 14 cents per pound. For the past 15 years the price of copper has been slightly in excess of 15 cents per pound. This is a good indication of the price at which the producer in the long run can afford to sell his product. For protracted periods it may be recalled that in the year 1906 copper averaged 19.7 cents per pound and that in the year 1907 the price of copper averaged 20.8 cents per pound.

"Even setting aside the abnormal amount of copper required for export on account of the war, which it should be pointed out is to a large extent actually destroyed, we have a condition calling for a high average price of copper, because all signs point to greater activity in industrial lines generally than existed during the period when the 15-cent and 16-cent averages obtained."

SWASTIKA

Swastika, Nov. 6.—Actual mining operations are now being carried on at the Swastika mine by Frank Culver and his associates, who purchased it recently. Drifting has been started on the main vein on the 200-ft. level and the ore is being hoisted.

Although little information has been given out, it has been stated on good authority that extensive development work will be done and a thorough test made of the property.

The Swastika was the first mine in the Kirkland Lake section. A small mill of five stamps was operated successfully for some time. When the mill-capacity was increased there was not sufficient ore to keep it running, and the company at that time was not in a position to carry on development work.

A rich gold discovery is said to have been made on the claim of Joseph McDonough at Minaloka, about 18 miles north of Cobalt, on the T. & N. O. Railway in Pavana township.

IRON ORES PRODUCED BY MOOSE MOUNTAIN, LTD., ONTARIO

The mines owned by Moose Mountain, Ltd., are located at Sellwood, Ontario, about twenty-five miles northwest of Sudbury, on the Canadian Northern Ontario Railway. The shipping port is Key Harbor, on Georgian Bay.

There are two different grades of ore produced at the mine; first, the cobbed ore. This ore is magnetite, and of non-Bessemer grade. Complete analysis of this ore is as follows:

	212°F.
Iron	54.45
Phosphorus	.105
Silica	14.55
Manganese	.07
Alumina	2.09
Lime	4.00
Magnesia	2.83
Sulphur	.036
Loss by Ignition	.75
Moisture	.63

The selling price for season 1915 is $2.85 per gross ton, delivered at Lake Erie ports, with a guarantee of 54.00% iron in natural condition.

The other grade of ore produced by the Moose Mountain Limited, is briquettes. These briquettes are made from ore running about 38.00% iron as it is found in the ground; it is crushed down practically to dust, and then, together with the screened dust from the cobbed ore, is concentrated by means of the Grondal wet process, and raised from about 38.00% iron to approximately 63%, and the phosphorus is lowered from about .070% to approximately .025%. This ore in the fine state is then pressed into the form of bricks and run through gas heated kiln, from which it comes out as the finished material.

Before the briquettes have passed out of the kiln and while still in a white heat, air is admitted and the oxygen is absorbed by the briquettes, which changes them from magnetite to hematite.

A complete analysis of the finished briquettes is as follows:

	212°F.
Iron	63.02
Phosphorus	.025
Silica	6.66
Manganese	.08
Alumina	1.00
Lime	1.50
Magnesia	1.53
Sulphur	.012
Loss by Ignition	...
Moisture	.50

On a guarantee of 62.84% iron natural and .025% phosphorus, the price of the Briquettes at lower Lake Erie ports for season 1915 is $4.78 per gross ton.

Oglebay, Norton & Co. are the selling agents of only Moose Mountain cobbed ore and the Moose Mountain briquettes.

The Moose Mountain, Limited, also supplies standard crushed stone, or trap rock.

The rock is hard, dense, durable, tough, and free from sulphides. Among its qualities are the following:

Density 3.08; Hardness, above 8, or approximately 80% of diamond (very hard); Color, dark greenish blue; Fracture, sharp and crystaline ; Breaks into good cubical shapes; Water absorption, practically none; Affect of acid test, practically none; Adhesion of bituminous or asphalt-cements to this stone is good

This stone will make a good crush stone aggregate for concrete construction with Portland cement, or with bituminous or asphalt cements, for many purposes, including road and pavement construction. The rock is offered in the following sizes:

Through 5″ ring and on 2″ring; Through 2″ ring and on $1\frac{1}{2}$″ ring; Through $1\frac{1}{2}$″ ring and on $\frac{3}{8}$″ ring; Through $\frac{3}{8}$″ ring and on $\frac{1}{4}$″ ring.

A CUSTOM CONCENTRATING MILL IN SLOCAN DISTRICT, B.C.

About a year ago Mr. J. P. Keane, who had been for some time engaged in developing the Wonderful mine, near Sandon, Slocan, British Columbia, undertook what was regarded by many as a doubtful enterprise, namely the operating of concentrating plant on custom lead-zinc ores. He succeeded much better than had been thought likely by most mining men in the district, but unfortunately, just at a time when he was obtaining all the ore that could be treated at it, fire destroyed the mill and left its energetic lessee seemingly without the facilities for continuing to carry on the industry he had launched and brought to a successful stage. However, little daunted, he cast about for a way out of the difficulty he had so unexpectedly become involved in, and in the course of a few weeks he had made tentative arrangements for the use of a concentrating plant situated near Rosebery, Slocan lake, and within two months of the burning of the Ivanhoe mill he was producing zinc concentrate from ore from the Lucky Jim mine. The following description of the mill now being operated by Mr. Keane was included in a report on Slocan district made by the Provincial Mineralogist of British Columbia after his visit to that region in 1911:

"The zinc-concentrating mill at Rosebery was erected a few years ago by the owners of the Monitor and Ajax, primarily for the treatment of ores from those mines, but also with the expectation of doing business as a custom concentrating plant in handling lead-zinc ores of Slocan district. The plant was designed and erected by Mr. J. C. Fernau (general manager for the Canadian Metal Co.) who at that time was associated with an attempt to devise some method of utilizing the zinc contents of these ores. The plant was started, but did very little work, the Monitor and Ajax mines having been closed, and later having had their entire plants destroyed by fire, while the custom work expected did not materialize.

"The site of the plant is at Rosebery, near the northern end of Slocan lake, adjacent to the tracks of the Canadian Pacific Railway branch line from Nakusp to Sandon, and on the shore of the lake. The site chosen is almost level, there being only an elevation sufficient for the railway-siding going over the top of the receiving-bins, which are on the ground. The mill building is excellently built, and the machinery is good of its kind, but the design of the mill is such as to entail an undue amount of handling and elevating of material.

"The plan of handling the ore was as follows: The ore was received by train on the Canadian Pacific Railway and dropped into the receiving-bins, of which there is a row 250 ft. long, the bins and track being covered by a well-constructed building. The ore from the receiving-bins was discharged by chute-gates into 2-ton cars standing on a track outdoors; these cars were shoved by hand into the mill building, and there hoisted on a platform elevator to the upper floor of the mill and run off to the Blake jaw-crusher. The crusher discharged on to a travelling picking—or sorting—belt 20 ft. long by 2 ft. wide, which, in turn, discharged into a Gates fine crusher, the discharge from the Gates crusher passing into the boot of a bucket elevator, by which the ore was again raised to the upper story of the mill. The falling ore passed through a Snyder sampler into a bin, the sample going to a Gates sample-crusher.

"From this ore-bin the ore was fed by an automatic feeder to a pair of Hadfield rolls, which discharged into the boot of a second bucket elevator, by which it was again elevated to the top of the mill. This second elevator discharged into a series of four trommels with 12, 8, 4, and 2-mm. screens, respectively, the undersize of each passing to the next of the series, and from the 2-mm. on to a Culver classifier, which, in turn, discharged into a settler 40 ft. long. The overflow from the settler went to the tailing-dump and the settlings to the tables, of which there are two Wilfleys and six Luhrig vanners of a type selected by Mr. Fernau. It is said that there were formerly 18 of these vanners.

"The oversizes of the 12, 8, and 4-mm. trommels each passed on to a 4-compartment jig; the oversize from the 2-mm. trommel and from the three compartments of the Culver classifier each passed on to a 5-compartment jig. The middling of all the jigs was sent to the bucket elevator and returned to the rolls and trommels. The products of the jigs and tables passed to a 3-compartment bucket-elevator and were hoisted and deposited in bins.

"The power for the mill is provided by water-wheels, a 5-ft. Pelton driving the rough crushing plant and another the remainder of the machinery.

"The object of the plant was to make a separation of galena, zinc-blende, and iron-pyrites, making a zinc-blende product that would be sufficiently high grade to be marketable."

Changes made by Mr. Keane provide for the discharge of the ore from hopper-bottom railway cars on to a floor on a level with the top of the jaw-crusher, so that it is easily shovelled into the crusher; also the substitution of six Wilfley tables for the Luhrig vanners. Other improvements include the putting in of a small Pelton wheel for driving the dynamo for providing for electric lighting of the mill, and of large stoves and drums for heating purposes in cold weather.

It is of interest to add that the first car of concentrate, containing 42 per cent. zinc, was loaded and billed out on October 30th, consigned to zinc smelting works at Kenosha, Kansas, U.S.A.

MONARCH MINE

The Golden Star, published at Golden, Northeast Kootenay, British Columbia, recently printed the following information relative to the Monarch lead-zinc mine, on Mt. Stephen, near Field:

As soon as the steam plant is completed at the Monarch mine 60 tons of ore will be treated daily. This plant will be of 100 h.p. and will take the place of the hydro power used heretofore.

It is hoped with this improvement to be able to ship high-grade concentrates regularly, and work is progressing with a view to opening new ore bodies and keeping a good reserve blocked out. The mine and mill employ about 25 men and this number will soon be added to.

The Monarch has been worked with indifferent success for a number of years and appears now to be coming into its own.

The region in which the mine is situated gives promise of developing other good properties, included among which is that of W. T. Oke, located three-quarters of a mile across the Kicking Horse river. This property has a tunnel about 100 ft. into the hill, which has developed some high-grade ore. Picked samples from the dump run 70 per cent in lead and 20 per cent in zinc. The material is a good concentrating ore, and may be put through the same process as that of the Monarch using Huntington mills and Wilfley tables.

PROFIT SHARING

Charles M. Schwab is a great believer in profit sharing as between money power and brain power. Capital is much more in need of brain power than brain power is of capital.

It was brain power, and capital sharing with brain power, that drove the Carnegie Steel Co. to the head of the steel industry of the world, under Andrew Carnegie and Charles M. Schwab, in a comparatively few years. Carnegie was the salesman and financier. Schwab was the ever-expanding maker of steel. Carnegie and Schwab so thoroughly understood each other in constructive development and profit-sharing that it was not necessary for them to confer more than once or twice a year.

Schwab planned the Homestead steel works, to cost $10,000,000, an enormous undertaking for that period. The first that Carnegie heard of it was when he arrived in Pittsburgh from Scotland one morning and Schwab laid the plans before him.

"Charlie," he gasped, "where would we ever sell the entire output of such a plant?"

"Look here, Mr. Carnegie, at these statistics showing the annual consumption of steel in this country. See in how few years the demand doubles."

"Never in the world could we sell such an output," responded Mr. Carnegie. "Charlie, put those plans right in your drawer and keep them there. Don't show them to anybody.'

The great general is first a great soldier and Schwab was Carnegie's most loyal soldier. Without a word those plans were laid away and soon forgotten. Within two years the cable came from Scotland: "I have borrowed the money here. Build the Homestead."

It took all the organization ability of Schwab to rush those works to completion in time to meet the rising American demand for steel. In a few years the Homestead was but a small part of the Carnegie works whose total annual net earnings were four times the construction cost of the Homestead. Today the entire Carnegie works are but a minority in the United States Steel Corporation where the units of construction are now $100,000,000 as in the Gary plant at Chicago.

But Schwab never could be converted by Morgan or his associates in the United States Steel from the profit sharing plan—the union of brain and capital -that made the Carnegie works. He was never again comfortable in the steel business until he had the Bethlehem Corporation well in hand, and a free field on the old Carnegie basis.

Schwab's system is quite the reverse of the usual division. If a manager gets 5% of the gain in his department he does not get a lessened proportion for any additional gains; he gets an added proportion on the whole. Where there is a million dollars gain and a manager gets 5%, or $50,000, if he makes a $2,000,000 gain he may get 7½% upon the total, or $150,000. In some cases this bonus starting at 5% runs in increasing ratio to 15% on the entire gain, so that the manager has the stimulus not of working for the first gain and being satisfied, but the stimulus of burning his brain tissue every day and every minute of the day from the beginning to the end of the year, for an ever increasing percentage of reward.

Last January Mr. Schwab sent his engineers from the Bethlehem Company's works in California, Massachusetts and Pennsylvania over the Canadian line to do a rush order for the British government. The bonus on the $22,000,000 contract was one million dollars divided between the Electric Boat Co. and Bethlehem. That bonus was made in a few months and the men who directed the work in Canada got the Bethlehem half of it.—Boston News Bureau.

THE ELECTROLYTIC PRECIPITATION OF GOLD, SILVER AND COPPER FROM CYANIDE SOLUTIONS*

By G. H. Clevenger

The present unsettled condition of the metal market, more particularly as regards zinc, which is used now almost exclusively as a precipitant in the cyanide process, makes a consideration of electrolytic precipitation, which is apparently the most feasible substitute, of particular interest at this time.

The electrolytic precipitation of gold, silver and copper from cyanide solutions in connection with the cyanide process of gold and silver extraction, has freqently been the subject of satisfactory laboratory experiment, but much less frequently of successful commercial application. This comes about through the fact that experiments carried on for a few hours in the laboratory give no true indication of the life of anodes, formation of by-products, etc., to be expected in continuous operation.

The solutions which are precipitated in present-day cyanide practice may contain a great variety of compounds arising from the decomposition of the cyanide, as well as from its combination with elements occurring in the ore treated, or introduced by chemical methods of precipitation. The principal constituents of such solutions, if zinc precipitation were not used, would be: Simple alkaline cyanides, alkaline hydrate, gold and silver, and copper if it occurs in a soluble form in the ore undergoing treatment. The proportion of these various constituents present, particularly of the gold and silver, is extremely small compared with the amounts of metal present in solutions made by extraction processes in other industries.

In general the simple alkaline cyanide, as indicated by the Liebig titration test, will range in present-day practice from a trace to 0.25 per cent, or a maximum of 1/400 of the solution. In certain cases of sand treatment of silver ores stronger solutions are used, but in general the cyanide strength of the solutions precipitated will fall well below the upper limit given. The alkali generally added is lime, although caustic soda has been used. There is rarely over 100 points present and most generally much less than this, and in some cases practically no protective alkalinity. (One hundred points of alkali correspond to a saturated solution of lime in distilled water at 20° C., i.e., 0.13%). The proportion of alkali present is therefore in many cases less than the cyanide.

The gold present will range from nothing to 0.5 ounce per ton, and the silver from a trace to 10.0 ounces per ton. In general the proportion of gold and silver in solution is much less than the upper limits given.

The grade of the ore treated does not always form a safe criterion of the gold and silver content as the solution, for the reason that the ratio of the weight of solution used to the weight of ore treated, or, as it is generally termed, "the dilution," varies greatly, but in general, as might be expected, is greater with high-grade ores. Thus, if three tons of solution are used in treating one ton of ore, we have a 3 to 1 dilution, and the recoverable value of the ore has been transferred to three parts of solution, the average value of which would be one-third of the recoverable value of the ore treated; or, to take the concrete case of an ore assaying 0.50 oz. of gold per ton (approximately $10 per ton) from which 90% of the gold can be extracted by cyanide solution, there would be dissolved by the solution 0.45 oz. per ton of ore treated. With a 1 to 1 dilution the average content of the solution per ton would be 0.45 oz., with a 3 to 1 dilution the average content of the solution per ton would be 0.15 oz., with a 5 to 1 dilution the average content of the solution per ton would be 0.09 oz.

It will, therefore, be apparent that this stage of the cyanide process, the transference of the gold and silver from the solid state as occurring in the ore, to the liquid state as dissolved in the cyanide solution, is unlike most other steps in metallurgy, which are in general to successively concentrate the metal sought into a smaller weight of material. Exceedingly small as is the proportion of gold and silver present in ores which it is possible in present-day practice to profitably treat by cyanidation, the proportion of gold and silver in the solutions requiring precipitation are generally still smaller.

Perhaps a clearer idea of the small amount of metal involved, particularly in the case of gold, will be obtained by expressing the proportion fractionally. In solutions containing 0.50 oz. of gold per ton, an unusually high proportion, the gold would form only 14.6/1,000,000 or 1/58,332 part of the solution. In the case of waste solutions, which are or should be precipitated before they are discarded, it is not unusual to deal with solutions containing less than 0.01 oz. of gold per ton, or only 1 2,916,600 of the total weight of the solution. Tail solutions containing only 1 or 2 cents values per ton are regular practice at many mills using zinc dust precipitation.

At the present market price of silver (about 50 cents per ounce) there would be required about forty times the weight of gold present to give an equivalent value in silver. Therefore, in the treatment of silver ores a much greater weight of metal would be involved, but still the relative proportion of metal to the total weight of solution is small. As gold and silver most frequently occur associated, the absolute weight of metal to be precipitated will depend upon the ratio of these two metals in the ore treated. The greater weight of metal involved in the treatment of silver ores or ores in which silver predominates, perhaps in a certain measure explains the greater ease with which solutions resulting from the treatment of such ores are handled by all precipitation processes.

Copper in solution is an incident of gold and silver extraction, as at present there is no effort made to recover copper in this way; however, this is an interesting possibility, and would be feasible provided the cyanide combined with the copper could be economically regenerated. In many cases the proportion of copper in solution will be less than that of the gold and silver, and, so far, even with electrolytic precipitation, there has been no serious attempt to treat gold and silver ores by the cyanide process unless the proportion of readily soluble copper was considerably below 1.0 per cent. The interference of copper with other methods of precipitation, as well as its prejudicial effect upon extraction, make a consideration of its behavior with electrolytic precipitation of particular interest, but beyond the province of the present paper.

The electrolytic precipitation of gold and silver from cyanide solutions, therefore, involves the practically total precipitation of an extremely small weight of metal from solutions containing a comparatively small proportion of soluble salts, and which are therefore poor electrical conductors. The fact that the alkaline cyanides are readily decomposed by electrolysis and that the economy of the cyanide process depends upon the continued re-use of the solvent make it imperative to precipitate with the minimum decomposition of cyanide, and preferably with a regeneration of cyanide. The difficulty of the problem at best will therefore be apparent.

* Extracts from a paper presented at the 28th general meeting of the American Electrochemical Society, in San Francisco, Sept. 16 to 18, 1915

ILLUMINATION OF COAL MINES

By Robert P. Burrows, Cleveland, Ohio

In preparing this paper the object has been to set forth facts relating to illumination problems, which, judging from the results realized in the iron and steel and other industries somewhat similar to mining, will tend toward furthering safety, production, and contentment of employees, as well as economy of operation in mines. By applying the principles of illumination with the assistance of modern appliances, the full benefits in efficiency may be derived from improvements already made in other details of mine operation.

The lighting of a typical coal mine may be divided into four distinct parts: (1) The lighting of the buildings about the top; (2) the lighting of the working faces; (3) general illumination at the bottom; and (4) special applications of lighting.

The lighting of buildings about the top may be treated in the same manner as that of any other industrial plant, for we have a boiler room, an engine and generator room, a forge, a machine shop, and a hoist room. These can be well and efficiently lighted by the use of 100-watt tungsten-filament multiple lamps with proper reflectors so spaced and suspended that a power consumption of from $\frac{1}{4}$ watt per square foot in the boiler room to 1 watt per square foot in the machine shop is obtained. The methods that apply to this kind of lighting have been ably treated by a number of authors, and for this reason a detailed discussion is unnecessary.

The lighting of the working faces is usually done by means of portable lamps, of which there are four types in use: The oil torch, the acetylene lamp, and the oil and the electric safety lamps. The different types have been fully described in numerous papers and articles and will not be covered here, although a few figures on the cost of operation will no doubt be of interest. In attempting to obtain cost figures, one is impressed with the fact that apparently very few such data have been obtained in this country. It would seem that such data would be of particular benefit at this time, with the advent of the electric safety lamp.

The oil torch is without question the cheapest source of light. The acetylene lamp, at a cost of 6c. to 10c. per lamp per week, gives far superior illumination but the characteristics of this source of light as well as any other open-flame lamp will bear careful consideration in view of the ever-present desire for industrial efficiency and safety. It is the opinion of many that the greater percentage of disastrous explosions in the United States have resulted from the use of open-flame lamps in the so-called non-gaseous mines. This question of safety, of course, merits serious consideration.

The oil safety lamp has a distinct advantage in that it gives an indication of the presence of gas. Its development marked one of the greatest advances in mine lighting, although in most cases at the present time it is not considered a guarantee against explosion when in the presence of gas. Figures obtained from foreign countries indicate the cost of using oil safety lamps is from 7c. to 9c. per lamp per week.

The electric lamp gives a steady and readily directed light, free from gases, soot, and large chances of outage. A large proportion of the generated light is directed on the working face. It is sometimes considered a disadvantage that the electric safety lamp does not give an indication of gas as does the oil safety lamp. The trend of opinion in England, however, is toward choosing a lamp for the light it gives and to use some other means for gas detection. There is no question that an electric lamp passing the tests of the U. S. Bureau of Mines will give more light on the working face than any of the three previous illuminants, because it has been scientifically designed with that end in view.

Foreign practice has shown that electric light costs from 12c. to 17c. per lamp per week. This cost is about twice that of the oil safety lamp. The light on the "face," however, is materially increased by the use of the electric lamp. One foreign electric-lamp manufacturer places the cost of electric light at $2\frac{1}{2}$c. per lamp per shift. This figure, though it seems low, can well be realized in this country with a large installation and proper care. In this connection, it is very necessary to have proper housing and proper attention for electric lamps, more so than with the oil safety lamps. It has been found in foreign practice that this care and attention is very little, if any, more expensive than the attention that is given to oil safety lamps even though more expensive help is needed, because fewer men are required to care for the electric outfits. This country has been slow in taking up the electric lamp. It has been said that in Belgium alone there are 12,000 outfits in use. The excellent work done by the U. S. Bureau of Mines to obtain the highest efficiency for this new source of illumination has accomplished what years of competition among electric mine-lamp manufacturers could hardly have brought about.

The application of the principles of industrial illumination to the general lighting of mines must be made in the face of conditions difficult to overcome. In fact, all the conditions the illuminating engineer considers most difficult are present: low ceilings, black walls, dust, smoke, and dampness but in spite of these, satisfactory results have been obtained.

An ordinary coal mine, from a lighting standpoint can be considered as composed of at least six parts: the bottom, the run-around, main entry, side entries, mule stables, and small rooms, such as offices, pump rooms, storage rooms and first-aid rooms. The bottom, being the entry and exit for both men and coal accommodates more traffic than any other part of the mine and should be especially considered from the standpoint of both convenience and safety. The lighting of the shaft in one well-lighted mine was accomplished by the use of 40-watt tungsten-treatment lamps equipped with angle reflectors, placed above and across the shaft opening so as to direct the light on the cages. The maximum intensity is at the near edge of the cage, and the eyes of the workmen on the side of the shaft toward the observer are not subjected to the glare of the lamps.

That portion of the bottom leading into the mine, where cars are directed on to the cages, can be well lighted with 40-watt tungsten lamps in shallow dome reflectors placed above and between the tracks. These units spaced at about 9 ft. intervals and hung about 8 ft. above the floor, will give satisfactory distribution of light. The car wheels are thus well illuminated and there is practically no glare. It would be well to design the lighting of this part of the mine on a basis of 4 to 5 foot-candles at the floor, not because the work demands this intensity, but because of the greater safety which results from ample illumination and because dust collecting on the lamps and reflectors decreases the amount of light delivered.

The run-around should receive only sufficient light to make visible any obstructions in the path of the empties as they leave the cages. This part of the mine may be illuminated with 25-watt tungsten lamps equipped with shallow dome reflectors about 15 ft. apart and suspended

8 ft. above the floor. In the main entry, the function of light is not so much to illuminate as to silhouette objects which may obstruct the passageway. With silhouette lighting a comparatively small amount of light is needed to obtain the effect desired, which is to see objects outlined against something that is lighted. For instance, white-washed doors or walls reflecting the light toward the observer's eye are excellent backgrounds against which objects form silhouettes when in the line of vision of the observer. The glint of the light on the rails forms another good surface from which silhouette lighting may be obtained. With 25-watt tungsten lamps in shallow dome reflectors, spaced at intervals of about 300 ft., the height depending upon the height of the entry, the silhouette lighting is excellent. Two units, one to illuminate the switch and the junction and the other illuminating a portion of both the main and side entries, help to eliminate collisions and by the increased light warn the trip driver that his train is approaching such a junction.

The mule stables with their low roofs may be effectively lighted with 40-watt tungsten lamps equipped with angle reflectors placed along the back wall and as high as possible one unit to each two stalls. In front of the stalls and opposite the angle units, 25-watt tungsten lamps with deep bowl reflectors may be used to illuminate the feed boxes and passageway.

The mine offices need but one 25-watt tungsten lamp equipped with a shallow dome reflector The fireboard at the bottom should be well illuminated with one or more 25-watt lamps of this type equipped with angle reflectors, depending upon the size of the board, while the pump rooms and storage rooms may be lighted in the same manner as offices. The first-aid rooms, in order that the best attention be given the injured, should not only be well lighted, but should have the walls well whitewashed, thereby obtaining well diffused and distributed light. Frequent whitewashing of the walls of the bottom, offices, mule stables, etc., and the walls of the entries for 20 ft. each side of the units, will greatly increase the illumination in these parts of the mine. Carbon lamps are generally used in mines, but to keep the load on the generator as low as possible and maintain the most constant illumination in spite of voltage fluctuation, and to direct the light where wall and ceiling reflection cannot be relied upon, tungsten-filament lamps with weatherproof enameled reflectors in my opinion will be found most satisfactory.

A few comparative cost figures in connection with the problem of more efficient illumination follow. Consider for example, an installation where twenty-six 40-watt tungsten lamps and reflectors and thirty-one 25-watt tungsten lamps and reflectors are to replace the same number of 32-cp. and lamps, respectively. During a period of 300 days, at 10 hr. a day, the tungsten lamps would consume about 5,440 kw-hr., while the carbon lamps would consume about 14,940 kw-hr. With the cost of current at 0.5 c. per kilowatt-hour, the saving in cost of power with the use of tungsten lamps would be about $50 a year. From this must be subtracted about $17 for the difference between the cost of the carbon lamps and the tungsten lamps. This will leave about $23 net saving. With the reflectors costing $60, the installation would be paid for in three years.

These figures tend to show that if dollars and cents alone were considered, it would be more profitable to use the higher efficiency lamps. This is even more marked when the illumination of the working place is considered, because with the use of reflectors this illumination is more than double that obtained with carbon lamps.

There are many other places where special applications of lighting would tend to increase efficiency and convenience; for instance, trip-lights—now as a rule simply oil torches on the end of the train—could be easily replaced by small storage-battery outfits showing a red light. Locomotive headlights can be equipped with low-voltage concentrated-filament tungsten lamps in parabolic reflectors, with a decrease in trouble, increased light, and decreased breakage over the present carbon or regular tungsten filament. Two 30-volt, 100-watt tungsten-filament locomotive-headlight lamps can be burned in series with a resistance. The loss in current through the resistance is a small factor as compared wih the gain in steadiness and brilliancy of illumination from the parabolic headlights. The construction of this lamp is such that maximum strength of filament is obtained, which is an essential feature where the service is as severe as on a locomotive. Another possible consideration is the placing of distinctive lights where telephones are located, or where first-aid equipment may be obtained. This could be accomplished by the use of red lights on the power circuit installed in connection with a small primary-battery system, which would operate a miniature lamp in place of the large lamp should the power circuit for any reason fail. This system has been successfully worked out in theatres where the same principle is involved.

It is hoped that, from the few figures given in this paper, it will be seen that the application of the latest scientific knowledge to the lighting of mines is not so expensive as it is generally thought to be, and should be considered as a means of increasing safety, bettering working conditions, increasing production, and at the same time decreasing the cost of operation.

THE NOVA SCOTIA MINING SOCIETY

The Council of the Nova Scotia Mining Society have decided not to hold the Annual Meeting and Dinner in April of next year. The decision of the Council not to hold the Annual Meeting last April met with the general approval of the members. It was then felt that a meeting without the usual social functions and without the dispencing of the usual hospitality to the Society's guests would not be as successful as could be wished, and these reasons appear not less cogent at the present time. In lieu of expenditure on the Annual Dinner the Council decided to make a donation of one hundred dollars to the Nova Scotia Red Cross Society. Since the last annual meeting a welcome change has come over the mining industry of Nova Scotia. A year ago, trade conditions were gloomy, and the mines were working irregularly. The prospect for the future both in the coal and iron industries was uncertain. Today, however, the members of the Society are all hard at work producing coal and making steel to help the general cause. The membership and finances of the Mining Society are in excellent condition. The decision to defer the holding of functions of a semi-festive nature, such as the annual dinner of a healthy mining society, is in consonance with the action of other mining societies throughout the Empire, and is commendable.—F. W. G.

NOVA SCOTIA STEEL

Nova Scotia Steel & Coal Co., Ltd., has sold to New York interests $1,500,000 of its common and $1,000,000 of its 6% debenture stock, according to an official announcement.

The new working capital obtained by the sale of the securities will greatly strengthen the financial position of the company and permit it to accept business which it is not able now to take care of. Nova Scotia Steel already has large orders for munitions and other material on hand.

Nova Scotia Steel & Coal's capital is now as follows:

Common stock, $7,500,000. Preferred stock (6%), $1,030,000; Debenture stock (6%), $4,000,000; Bonds (5%), $5,873,809; Total, $18,403,809.

THE EARLY BIRD

By J. Harmon Patterson

The tide of discovery was moving westward and wherever prospectors foregathered that winter the same vague rumor was afloat. Nothing definite of course. No one even so much as gave a hint of where he intended to strike in the Spring. Each had a definite plan, but this was more than I had. I was already hired for the season by a good syndicate and on very generous terms—but where was the new field? The country was large and no detailed map of it was in existence. I wanted one badly, but no government explorer had given it his attention. Well if he had not, some Indian trapper had. I would hunt up Fred my Indian guide. He would know.

I had trouble in locating Fred, but after a three days' journey into the wilderness I came to his shack. He and Indian Charley were trapping together. They were very glad to see me and for the next day we ate much of beaver and moose and of the good things I had brought with me.

The Indian who was my guide I did not trust, but the next day I got him out with Indian Charley and came to the point.

"Why yes," Fred replied in answer to my questions. "Charley trap there all one winter, know all the country, make a good map."

"And does he know diabase when he sees it?" I asked.

"Oh yes, he know diabase. Pretty nearly all rock he know," was his reply.

I made up my mind at once. "My idea is this," I told him. "You come with me of course and if Charley is willing I will hire him for a month or two to get in supplies We will not wait for Spring but strike in about the middle of March, find the best place, get in plenty of grub and stay on the job. But I don't want anyone to know where I am going."

"Good," was his reply, "can go in from here, only about thirty miles and good trail. Charley will go, not getting any fur worth while."

Next day I had a long talk with Charley.

"Coshawong lake place to go," he said. "Lots of diabase there, plenty big rocks. I see some calcite there too," he added, proud to show his knowledge of geology.

I went out next day, after arranging that they were to meet me at the railway with toboggans two weeks later. I gave Fred the money and he purchased the necessary supplies. Three days later we arrived at their camp with over two hundred pounds of provisions. I stayed in while they went out for another load. To the inquisitive merchant they explained that a fool white man who was not well was to stay with them for a month and was afraid that he might starve.

Then we made our way up to Coshawong Lake, arriving there after a hard trip of four days. Here we pitched our tent, set up the sheet iron stove we had brought with us and made everything comfortable. Then Fred and Charley went out for another load. During the week they were absent I made short trips around the lake and was much encouraged by what I saw. To the south and west the rock looked favorable wherever exposed. When they returned we had four hundred and fifty pounds of supplies, but I sent Charley back to the camp again for a lot of moose meat they had left, though he suggested that it would be easier to kill another moose. The meat at this time of the year is very good to eat and is a pleasant change from salt pork.

We then made long trips in every direction, often taking provisions and a fly with us and remaining over night but no place I saw could at all compare with Coshawong Lake, and I was soon satisfied to confine my attention to it.

It was now the last of March and the weather was quite mild at times, so I sent Charley out for his canoe which I purchased from him. I paid him liberally for his time and he left us well satisfied.

One afternoon while walking along the shore of a small lake about a mile from camp I saw a piece of calcite and soon uncovered a vein about six inches wide. It was almost pink in places with cobalt bloom. I traced it for about twenty feet, but the snow was deep and I could not do much. We held a feast that night in honor of the discovery. We had moose soup with dumplings, boiled moose meat, boiled rice with apple sauce, real biscuits with butter and tea. Next day we carefully staked the claim. Then Fred found another good vein which we also staked.

As the snow melted more and more rock was exposed, and by the first of May we had five good claims, all adjoining. Though we had looked over the country pretty well we saw nothing else worth taking up, so a week later we decided that it was possible to get out to record the claims. That trip was a hard one. The rivers were open but nearly all the lakes were yet full of ice and there was much snow in the bush. We dragged the canoe across many a lake on the ice and over many a portage where the snow was still deep.

I was very glad at last to see the houses of the village in the distance. It is pleasant to sit up to a table again with a white cloth and eat a real meal from real dishes. Fred and I certainly enjoyed it though the food was no better than we had ourselves.

* * * * *

Ten days later I met Fred and we returned to our camp. The second day after our arrival we made a trip around the lake. Stakes everywhere. Not an inch of diabase left. We went back half a mile, still stakes. There were five tents and twelve men at the south end of the lake. Coming back we met four canoes and nine men who had just arrived. We went back to a ridge which we had seen in the spring, it was all staked.

The country was simply blanketed. The men did not grub around till they made a discovery and then stake a claim. They staked first and prospected later. Two young fellows who were prospecting found out that while they were at work other men had run lines around them.

That night when we got in we found seven men at our camp. They were all old hands and a hard bitten bunch they were. Most of them had been staking all day with no discovery. Just getting some ground as one expressed it. I gave them all the information I thought wise and a rough plan of the country. Each man made a copy.

We now got down to hard work on our claims grubbing away among the roots and gravel to find other veins. We had visitors every day who examined our showings and all pronounced them very promising.

We had been at work a week when we made the big find. I had walked over the place several times. It was a small calcite vein about an inch wide. I knocked a piece out with the pick. The silver showed plainly as specks like moss. We borrowed a drill and a stick of dynamite, as we had none with us, and put in a shot. The vein was full of silver and a thin leaf lay along one split. No more work that day. The news spread like a forest fire.

I did not know that there were as many men on the lake as came to see our find next day. They swarmed over that little vein like bees around a piece of honey. Every man picked away till he got a sample and all were greatly excited. They talked of another Cobalt and were loud in their congratulations.

Good old Fred went about with a smile that stayed. I really believe that he was as pleased as I was over my good luck. "Yes," I heard him say, "We find it, come here in the winter. Stay on the job, pick the best, then go out and record it."

A crowd of prospectors gathered in our camp that night. Nothing was talked of but our discovery. Everyone who had claims staked around the lake suddenly saw visions of great wealth before him. I determined not to get enthusiastic. I owned a one fourth interest in any property discovered and this might turn out to be a bonanza. Of course the vein was small but it was very rich, and there must be more. I could not help having a sort of opulent feeling. Anyway we could have a larger house and my wife could keep a servant and have more money to spend on dress, and have, perhaps, her heart's desire, an automobile, just a small one. We might find a large vein as rich as the small one. We'll dig in and try. I might get fifteen or twenty thousand, ten at least. It makes me dizzy.

I had written the syndicate telling the good news and asking them to send a man in at once. I sent the letter with a couple of prospectors who were going to record.

Day after day we worked hard stripping and trenching. We found another vein, narrow but as rich as the first and traced it for some distance.

Langton, one of the syndicate, arrived one day about noon very much fly bitten. After we had lunch we took him over to the claim, put in another shot and blew out a lot of silver.

"You certainly have the goods," he said eagerly examining piece after piece. "Do you realize that there is a bunch of money in this for us all?"

"I've had a few pipe dreams about it," I replied, "but the vein is narrow."

"What do you want, a mint?" he asked. "As soon as we got your letter the boys asked me to come up and see just what you had, but we had no idea that it was as rich as this. They will be pleased I can tell you."

"Now listen," he continued, "you know well that this looks fine. These claims may be worth a lot of money or we may spend a lot on them and lose it all. I am going to make you a sporting offer. We will give you five thousand dollars cold cash and cancel the contract."

I did not expect anything like this. I knew the game and knew the chances even on a showing as good as ours, and I had a dread of joint stock companies.

"Tell you what," I replied, "You have only seen one vein. We have another as rich. I will take six thousand five hundred and get out." We had not mentioned the other vein which we were keeping as a surprise.

"Another vein! Great Scot! Let's see it," he exclaimed.

We went over and examined it. Then he held out his hand.

"Done," he said, "Shake on it."

ACCIDENTS AT METALLURGICAL WORKS

The first report of the United States Bureau of Mines on accidents at metallurgical works has just been issued by the bureau and includes the calendar years 1913 and 1914. The figures, compiled by Albert H. Fay, engineer, show that 119 men were killed during the two years; 2,285 seriously injured; and 11,046 slightly injured at smelters and mills, representing fatality and injury rates of 1.55, 29.67, and 143.44, respectively, per 1,000 men employed. The report includes the returns of 79 smelting plants in 1913 and 94 in 1914, including copper, lead and zinc, and quicksilver smelters, as well as refineries. The iron blast furnace figures are not included. The number of ore-dressing plants in 1913 was 311, and in 1914, 484. These represent concentrating plants of copper, lead and zinc ores, stamp mills, cyanide plants, and iron-ore washers.

The total number of men employed in the metallurgical plants, both smelters and ore-dressing plants, was 35,549 in 1913, and 41,461 in 1914.

In the ore-dressing plants machinery was responsible for 25.6 per cent of all fatalities, 28.9 per cent of the serious injuries, and 16.5 per cent of the slight injuries. Similar figures for smelting plants are much smaller, for the reason that there is more machinery in use in ore-dressing plants than in smelters, and the men are usually in closer contact with the machinery, as, for example, at jigs, tables, stamps, rolls, and crushers. There are many revolving shafts, a large number of which have projecting keys, moving belts, wheels, and cams within the reach of the operator. The machinery at smelting plants is usually confined to the power house, where the blowers, engines, and dynamos are placed, and to overhead cranes, most all of which are entirely out of the reach of the regular employees.

The percentage of accidents due to "falls of persons" and "flying and falling objects" is 15.4 per cent for each in ore-dressing plants, whereas at the smelters the fatalities due to falls of persons represent 20 per cent of the total, and those due to flying or falling objects represent 5 per cent.

Haulage systems claim 25 per cent of the fatalities at smelting plants, and about half this percentage at ore-dressing plants. The difference is largely due to the type of material handled and to the larger number of cars in operation around smelter yards than are at ore-dressing plants. In many ore-dressing plants the ore is brought to the bins in railroad cars or aerial trams, and often there is no other haulage system in connection with the plants, the tailings usually being disposed of by launders or flumes, whereas at smelting plants the molten slag is handled in slag cars and the bullion has to be handled on trucks.

At smelting plants burns from hot metal, slag, etc., claim the largest percentage of serious and slight injuries and 11.3 per cent of the fatalities.

IRON AND STEEL

Iron Age says: October goes down as the month in which United States iron yield reached 3,000,000 tons and daily output crossed the 100,000-ton mark. When war order tonnages of six figures are bandied about so commonly, it is hard to believe that the year opened with a daily pig iron production of only 51,000 tons, or half what it is now.

More furnaces are preparing to go in blast, but some of the steel companies' furnaces that have been hard driven for months must soon go out for repairs.

An extraordinary situation exists regarding prices of finished steel. Orders have been sent in with request that they be entered and buyer notified of price. In most lines it is a question of finding a mill that can make delivery desired. Mills are holding back demand for next year. Only the largest buyers seem able to get protection on manufacturing costs for 1916, and some manufacturing consumers may find output curtailed by lack of steel.

Cabled statements that the allies will cut down purchases of American steel because of high prices need not be taken seriously. Such buying has been, and is still, insistent. American steel makers have really been slow to believe what is now plain, that the dominant factor in the domestic situation is sheer tonnage of steel to be fired out of guns. In Great Britain government requirements for shell steel are beginning to occupy exclusive attention. A new inquiry there amounting to 2,000,000 tons

GRANBY CONSOLIDATED MINING, SMELTING AND POWER COMPANY, ANNUAL REPORT

In a letter dated September 30th, 1915, to Granby shareholders, President Wm. H. Nicols says:

The results so far attained during the year ending June 30th, 1915, confirm our belief previously expressed that no insoluble problems exist with respect to operations of the new properties, and while those results are highly gratifying, it is reasonable to expect that considerable progress will yet be made in the line of further reduction of costs. Fundamental conditions both as to property and organization continue to be highly satisfactory.

The treasurer, G. W. Wooster, reports for the year as follows:

during the year were less than usual. The shipments for the year were 611,000 tons, the development work for the year added to the tonnage reported last year, 152,872 tons, the reserve tonnage in these mines at the end of the year showing 4,232,405 tons. The cost of 85 cents per ton of ore shipped is about 5 cents per ton higher than the average for the previous five years. This is due partially to the shut-down of last fall, and subsequent starting of operations in the winter, but it also reflects the increasing expense of extraction attending decreasing ore reserves, and wherever possible this tendency is being offset by improving and cheapening the methods of extraction.

Mineral Bearing Ores Treated.

Ores of	Ore smelted dry tons	Lbs. Cu. recovered per ton ore	METALS RECOVERED AND SOLD Copper lbs. fine	Silver ozs. fine	Gold ozs. fine	Value silver and gold per ton ore
Phoenix Mines	611,097	16.12	9,850,302	116,752	23,355	$0.857
Anyox Mines	462,340	34.58	15,895,757	142,725	3,581	0,308
Both Plants	1,073,437	23.99	25,746,059	259,477	26,936	$0.621
Foreign Ores Purchased	24,583		892,853	118,404	4,452	
Total	1,098,020		26,638,912	377,881	31,388	

Blister Copper Account—Costs.

Ores of	Copper	Per lb.	Silver	Gold	Total	Per ton Ore
Phoenix Mines..	$1,141,413.79	$0.1159	$ 56,483.94	$467,396.39	$1,665,294.12	$2.725
Anyox Mines....	1,604,469.34	0.1009	70,340.32	72,266.49	1,747,076.15	3.778
Both Plants.....	$2,745,883.13	$0.1066	$126,824.26	$539,662.88	$3,412,370.27	$3,179
Foreign Ores Purchased....	150,752.83	0.1688	62,108.17	88,097.60	300,958.60	
Total	$2,896,635.96		$188,932.43	$627,760.48	$3,713,328.87	

Blister Copper Account—Sales.

Ores of	Copper	Per lb.	Silver	Gold	Total	Per ton Ore
Phoenix Mines..	$1,588,176.97	$0.1612	$ 56,483.94	$467,396.39	$2,112,057.30	$3.456
Anyox Mines....	2,498,263.82	0.1571	70,340.32	72,266.49	2,640,870.63	5.711
Both Plants.....	$4,086,440.79	$0.1587	$126,824.26	$529,662.88	$4,752,927.93	$4.427
Foreign Ores Purchased....	150,752.83	0.1688	62,108.17	88,097.60	300,958.60	
Total Received..	$4,237,193.62		$188,932.43	$627,760.48	$5,053,886.53	

Profit and Loss Account.

To Blister Copper Account—Costs.....			$3,713,328.87
Less value gold and silver.....		$816,692.91	
Less value foreign copper purchased.....		150,752.83	
			967,445.74
		Per lb. Cu.	
Cost of Granby copper	25,746,059 lb.	0.1066	$2,745,883.13
To interest on bonds	.....	0.0105	270,419.53
To extraordinary expenditures		0.0055	140,972.25
		0.1226	$3,157,274.91
By copper	25,746,059 lb.	0.1587	4,086,440.79
Net Profit for year		0.0361	$ 929,165.88
Surplus carried over from last year			2,738,921.91
Total Surplus at Credit, June 30th, 1915.....			$3,668,087.79

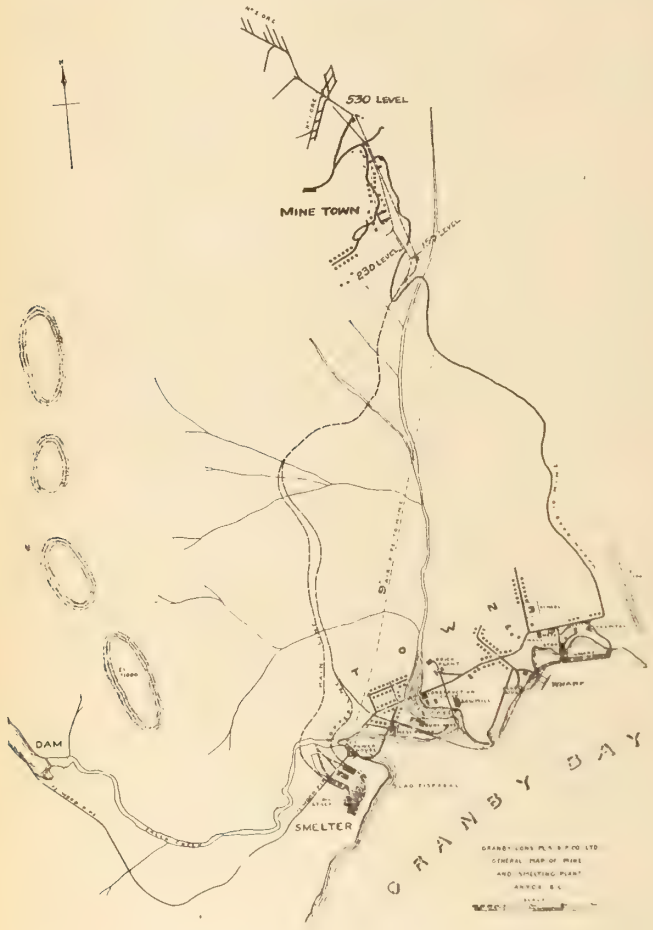
The general manager, F. M. Sylvester, reports as follows:

The operations at Phoenix and Grand Forks, B.C., were discontinued for four months after August 7th, 1914, and the output of ore from the Phoenix mines was curtailed after starting again in December, until April, 1915, so that the shipments from these mines

The first full year of operation of the Hidden Creek mine at Anyox, B.C., has been effective in development and ironing out the kinks and exercises of operation and cost of production incident to breaking in a new property, and putting it on a productive basis, and has shown conclusively that the general layout and development of the mine will afford and permit the output

of any reasonable tonnage required by the smelter, at a cost per ton well within the economic limits for such work. The shipments from this mine for the year were 477,435 tons. Very little development work was undertaken, but this work for the year on ore showing 2.2 per cent. copper added to the tonnage reported last year about 187,500 tons. The reserve ore (having 2.2 per cent. copper) at the end of the year was 9,205,837 tons. There is a further reserve of low grade (.63 per cent. copper) ore of about 8,628,000 tons. The cost of mining per ton of ore shipped for the year was $1.03.

At the Bonanza mine, located about 2 miles up Bonanza creek—which is a tributary to Granby Bay, two miles south of the smelter—nothing has been done dur-



ing the year, either in the way of development or in preparation for shipping ore. The ore roughly blocked out by the work previously done on this property shows for a grade of 2.6 per cent. copper, 414,775 tons. There is, in addition to the above, a grade of .7 per cent. copper, 489,580 tons.

The quartz claims—consisting of 30 claims, located on Granby peninsula, which forms the easterly shore line of Granby bay—were purchased during the year. The property has been opened up to afford a source of supply for clean quartz when it is required by the furnaces. For this purpose much preliminary work, by way of clearing and stripping the ledges at three different places and constructing rough loading chutes and wharves to load flat-deck scows, has been accomplished, and while at this writing very little quartz is being taken from this quarry, it is in readiness for shipment whenever required in the future.

On the Kasaan peninsula of Prince of Wales island, southeastern Alaska, the company owns the Mamie and Dean mines and has an option to purchase the It mine, adjoining the Dean. Work on all of these properties was discontinued in August, 1914, until April, 1915. These mines are comparatively small. However, the results of the work on them, up to the present writing, give sufficient encouragement to warrant the continuation of this work of prospecting for and seeking an extension and enlargement of the known orebodies. From these mines there has been shipped, during the fiscal year (of a grade of 1.5 per cent. copper), 15,000 tons, the reserve showing at 130,000 tons, with a fair prospect of developing treble this tonnage with future work.

At the Midas mines, Valdez, southwestern Alaska, such work as was necessary to complete the aerial tramway, mine terminal of this tramway, a few buildings at the mine, and to fill in about the pile foundation of the wharf shipping bins—to prevent destruction by teredos—was started in April of this year. At this writing this work is about complete and with the little development work that has been advanced in the mine during the year, this property will be ready to make shipments as soon as arrangements are made for securing power to operate the compressor.

The two reduction works owned and operated by the company are located, one at Grand Forks, B.C., the other at Anyox, B.C. The first named works have been in operation since 1901; the second since 1914.

At Grand Forks the operation is a simple one, all of the difficulties of treatment and handling of the Phoenix ores having been solved some years ago. This, with practically no expense for new construction, makes possible costs very substantially under those of recent years at this plant.

The operations of the smelting works at Anyox have been attended with many difficulties of a minor nature, and some of greater degree, resulting in a low tonnage, and, as naturally follows, high costs, particularly for the first eight months of this year. Most of these difficulties are of a nature having to do with establishing the best methods of handling the ores, which vary considerably in their silica, iron and alumina content.

The further difficulties were mechanical, and those inherent to a new plant, beginning its operation with new crews, and, as was the case with the mining operation at this point, the experience of the first year's operation has gone far in securing a condition of smooth running with lengthening campaigns for the furnaces and as a consequence a greater tonnage treated per month with constantly lowering unit costs. In this connection the writer believes that it is fair to assume that during the succeeding years of operation there will be noted the same constant lowering of unit costs as has been shown in the operations of the Grand Forks plant, and that this result will be attained in less time than it was at the older plant.

The plant—originally designed to treat 2,000 tons of Hidden Creek ore per day—has been well arranged and constructed for the economical treatment of these ores. The changes that have been made are minor ones, which actual operation has demonstrated would simplify methods and give greater efficiency. The addition of the fourth furnace and appliances for taking care of fluedust—authorized during the latter part of the fiscal year—will undoubtedly raise the normal output of the plant as first designed, fully 50 per cent. Very little foreign ore has been treated at either plant.

Recoveries, including foreign ore, at the Grand Forks plant were: Copper, 10,041,175 lb.; silver, 180,177 oz.; gold, 27,807 oz.

The recoveries at the Anyox smelter were: Copper, 16,597,737 lb.; silver, 197,704 oz.; gold, 3,581 oz.

Mr. W. A. Williams, smelter superintendent, reports as follows on the Anyox smelter:

In its first real year of operation this plant shows, in ores treated and in copper produced, a good healthy progress for the better. Since high water in March, the plant has practically run at full capacity, having changed at that time from the old schedule of always operating two furnaces steady and the third in repair and waiting, as was formerly the practice, to keeping all three in blast as much as possible.

The new charge cars have helped the feeding and the distribution of the ore in the blast furnaces, and the tendency of the furnaces to crust has become less as a result of their installation. With the better understanding which everyone has of both the ores and the operation of the furnaces, the campaigns have lengthened, until campaigns of a month are now the rule. We look for this to improve as time goes on. This will give us more furnace days per year.

The troubles encountered on the lower floor were chiefly with the settlers and spouts, owing to the great amount of low-grade, corrosive matte handled. These have been overcome and we now have few stoppages from this source.

The stoppages of the crane service which troubled us at first have been entirely overcome with the installation of the heavier forty-ton trolleys with which we replaced the twenty-ton trolleys.

A number of improvements have been made in order to lower costs, such as silica bins over the converters, skull grid for ladle skulls, new charge cars and matte digging machine, all of which have been charged to "Operation." The No. 4 furnace and agglomerating plant were purchased this year and are now under construction. The furnace will be ready to put in commission by August 15th, and the agglomerator by September 10th. We are preparing to increase our storage capacity for ore by the erection of more bins. This work is charged to "Operation" and will be finished by November. We have found the plant fairly well designed for economical work and have made very few changes. So far, we have found it to be the better practice to regrade our matte, giving to the converters nothing less than twenty to twenty-five per cent. cu. matte. Everything is in good working condition.

We commenced operations as a pyritic plant, using low coke and very little flux, No. 1 ore being used as a base to melt No. 2 ore. We have been trying to make a converter grade of matte in the first operation. The ores have not come to us as free from inert material such as dyke and schist as we could wish. They have been more or less erratic as to silica content from day to day and the tendency in both ores is to higher silica and alumina. This fact coupled with the shipments of about 100 tons of foreign ore per day has made it hard to operate the furnaces as originally intended, and the coke and flux percentages have risen to some extent. With the greater development of our own ore bodies, and with the better storage facilities at the mine and smelter, this condition should be materially helped. The making of converter grade of matte in the first smelting, we believe, will eventually be accomplished.

With No. 4 furnace in operation the agglomerator handling our converter slag and matte cheaper, thus giving us a greater recovery per ton of ore owing to its handling the flue dust; with a fuller understanding of our problems; longer campaigns of the furnaces and with the labor-saving installations mentioned above, we should and will make a decrease in our costs during the coming year.

Last year's record, we believe, we will beat this winter, even if identical conditions prevail, as we know better what to expect. With an earlier start in the shipping matte to Grand Forks in order to conserve our water supply, and with steadier campaigns, we should show better results. February is the worst period during the low water season.

Of the Grand Forks smelter, Mr. Williams says:

The Grand Forks plant was completely shut down for one hundred and twenty-two total days. We were enabled to commence operating four furnaces about the first of January, 1915, six in February and March, seven in April, and in May we were able to operate on an eight furnace basis. We smelted 617,544 tons of ore and 648,751 tons of charge.

With this irregular running and small tonnage the smelting and converting costs were the lowest in the history of the plant in the face of the high siliceous ores handled and the very high siliceous slags made. The per pound cost of copper is high on account of the low-grade ore handled.

A great deal of credit is due Mr. Bishop and staff subordinate to him for this remarkable showing. The results go to show that very close attention has been given to detail.

Under an eight-furnace operation the total pay roll is 200 men. This means that 16.6 tons of ore were handled per man.

Mr. A. J. Bone, smelter superintendent at Anyox, reports as follows:

In the year ending June 30th, 1915, considerable advance was made in the metallurgy of Hidden Creek ores at the Anyox smelter. Each month almost without exception showed a natural improvement over the one preceding. We acquired a more extended acquaintance and experience with the ores; the workmen have grown more proficient, and, for the most part, what mechanical difficulties were presented have been overcome. At the conclusion of the year, and barely fifteen and one-half months since the original start was made, it is apparent from all angles that we are approaching that condition of smooth, steady running which characterizes operations of long-established plants.

The ores melted covered a wide range in analysis, from low silica, low alumina, requiring quartz and little coke to smelt, to the other extreme of high silica, high alumina, taking a basic flux and higher coke. Of late the tendency has been toward higher silica content. We are also receiving about 100 tons daily of siliceous custom ore. The result of these conditions is to curtail the use of quartz in the blast furnaces and increase the consumption of lime rock and basic "Mamie ore," and consequently the percentage of coke.

It may be suggested that as our slag is comparatively low in silica, the obvious remedy for increased silica in the ore would be to make slags higher in silica. In this connection it should be remembered that the bulk of the iron which enters the slag is oxidized in the furnace and combines with silica in conformity with the principle underlying slag formation in pyritic smelting, namely, that the temperature prevailing in the fuses determines the particular ferrous silicate which results. Working along natural lines, our endeavor would be to make more slag in the furnace—not to alter its character. In other words, to obtain

ing a greater degree of oxidation, more ferrous oxide will be furnished to slag silica, and at the same time make less matte but of higher grade.

During the last quarter of the year, the first matte, when too low grade, has been re-smelted with siliceous ore and brought up to 20 per cent. to 25 per cent. Even this grade can be considered low as converter mattes go, but with it, the converter department can produce at the rate of three million pounds per month with ease.

One of our chief concerns is to make matte of suitable converter grade in the first smelting, and, though no permanent success in doing this can yet be recorded, it is not improbable that efforts in this direction will be successful.

Recently the system of feeding the furnaces was improved through the adoption of Anaconda type charge cars. These permit a more favorable placing of the charge, the advantage of which was immediately reflected in a marked decrease in crust formation. Incrustation in the upper part of the furnace shaft has been responsible for terminating fully ninety per cent. of the campaigns. These for the year were very brief, averaging only 13.6 days, but with the new cars, longer campaigns are the rule. A saving of labor on the feed-floor was also made possible by the new cars.

The prolific fall of low-grade, corrosive matte imposes a duty on furnace connections and settlers probably without precedent in the practice of copper smelting. Means to cope with this condition have been devised, and the furnaces are no longer subject to the frequent interruptions by purely mechanical mishaps which proved so embarrassing in the past.

In the converter department new steel silica bins were built and so located as to permit feeding silica to the converters without resorting to the use of cranes.

Mr. W. B. Bishop, smelter superintendent at Grand Forks, reports as follows: The Furnace department smelted:

	Tons.
Granby ore	611,007
Foreign ore	6,537
Anyox matte	6,359
Converter slag and matte	23,326
Flue dust	1,522

The average percentage of coke used per ton of ore was 13.17. The average smelting cost for the year was $1,187 per ton as against $1.217 for 1914 and $1.214 for 1913. There has been no new construction during the year, but repairs have been kept up and the plant is in first-class operating condition. Our costs are lower this year than any of the years past.

Mr. C. M. Campbell, superintendent of mines at Phoenix, says:

On account of the high price of copper during the past few months we have shipped about 85,000 tons of ore, from which a recovery of about ten pounds of copper and a correspondingly low amount of gold and silver, has been obtained. This ore was from areas where drill holes had shown the mineral zone to be too low grade to be included in the reserves. It also included sections which had to be mined, but which under ordinary conditions would have been handled as waste. The inclusion of this low grade ore resulted in a reduction in the recovery of total ore shipped from 17 pounds to 16 pounds. On the other hand the ore reserves are increased by this amount. Development work further increased the reserves by 66,872 tons, making a total increase of 151,872 tons. The present condition of the ore reserves is therefore as follows:

	Gold Drop	Ironsides	Total
Ore developed	1,431,000	13,853,240	15,284,240
Mine has produced and shipped	1,369,600	9,682,235	11,051,835
Remaining ore	61,400	4,171,005	4,232,405

From this we estimate that a recovery of seventeen pounds can be maintained. In addition to this there is a considerable amount, perhaps half a million tons, of ore which will average about seven-tenths of one per cent. in copper and forty cents in gold and silver.

ANYOX, B.C. GRANBY SMELTER AT RIGHT.

While the silver recovery has remained fairly constant the gold recovery has increased about ten cents per ton. This is due to the fact that when the mine was reopened in December the price of copper was low and development was directed towards those areas where better gold values were to be obtained.

With the declaration of war and the resulting low copper prices all operations ceased early in August and the property remained shut down for four months.

During the shut-down the No. 2 crusher, which handles the ore from No. 3 tunnel, was shipped to Anyox. There was little further need for this crusher. Nearly all the virgin ore on this level had been worked out and as the caved ore and pillars remaining could be handled more cheaply and the waste sorted out better by the electric shovel it was decided to wait until No. 2 level had been worked out and then remove the shovel to No. 3 level. Present indications, however, point to the Gold Drop being the first outlet to be worked out and in that case the crusher from there may be the one to be moved.

With the beginning of winter a considerable proportion of the resident population began to show signs of distress and the company were induced to reopen in a small way with a reduced wage scale in force. With the improvement in the copper market more outlets were reopened and more men put on. The loss of No. 3

tunnel ore was, however, a handicap and to overcome this the mine was operated from February 21st to the end of the year without an hour's shut down.

The chief novelty during the year was the satisfactory operation of the new electric shovel purchased during the latter part of the previous period. Considering the large amount of waste to be handled it is no easy task to get ore out at a cost that is attractive. However, during the past three months the ore from this level, considerably over half of which was from the shovel, cost about 75 cents per ton, crushed, in railroad cars, while the cost per ton for handling all material, ore and waste amounted to 40 cents per ton. Attention is now being directed towards improving the ore cars and haulage facilities. Originally five-ton side dump cars were used exclusively. In order to dump large masses of waste, handled by the shovel with chains, side dump cars in which the door automatically dropped were constructed. These cars have given a considerable amount of satisfaction and will be continued in use. An improvement, however, is a car which will hold close to ten tons, with the automatic side dump feature, but with the door so arranged that when open it will allow the passage of a rock four feet in diameter. One of these has already been built and is shown in the left foreground of the general view of the glory hole. Five more are under construction.

During December wages were subject to a reduction of 25 per cent., in January 20 per cent., and in February 10 per cent. The total deductions from the payroll for these months amounted to $13,482. During March normal wages were paid. With sixteen-cent copper market in April employees received a twenty-five cent daily increase. During May and June, when copper averaged over eighteen cents, the increase amounted to fifty cents per day. These three months, therefore, called for $16,052 in extra wages or $2,210 more than the total deductions for December, January and February.

Diamond drilling was mainly responsible for the increase in the ore developed. Underground drifting also added a little. Usually, stoping operations can be depended upon to add to the tonnage of new ore, but during the past year it was a question if the excess of ore in some places was enough to offset the shortage of ore in other places. The work for the year, however, showed a net increase.

A little work was also done on the Bank of England claim. The ore here is one of the footwall type similar to that encountered in drill hole No. 420, referred to in last year's report. Possibly a car load of ore may be obtained, but so far the ore taken out has been worked at a loss, and unless there is an improvement work here will soon cease.

The total ore that has been developed at the Gold Drop property amounts to 1,431,000 tons, but of this there is only 61,400 tons remaining. It is improbable that much more will be opened up, as the entire ground has been pretty thoroughly prospected. We are now able to say that the stoping loss at this property will be very small, probably about 15,000 tons or 1 per cent. This almost complete recovery can be explained by the fact that most of the orebodies have been small or medium sized and the entire tonnage could be extracted by leaving very few or no pillars. The largest orebody, which not considering the offshoots contained over 400,000 tons in one central mass, was almost completely extracted. While being mined pillars were left which were finally blasted. The broken rock was drawn clean, and almost completely. Owing to the good roof, the stope remained open for several months before it caved.

During the past year the Snowshoe claim has been drawn on heavily for ore. A little ore left there and on the Curlew and part of orebodies 5, 9 and 12 on the Monarch represent the localities where the remnant of ore left is to be found.

Mr. H. J. C. MacDonald, mine superintendent at Anyox, says:

The past year is the first in which the mine has been entirely upon a shipping basis. Some changes, some additions have been necessary, but on the whole the installation has demonstrated that it is well designed for the cheap handling of rock. The year has been one of progression towards smoother operation and lower costs. As the number and sizes of our stopes increased, the amount of powder and labor to break the ore has decreased. As the demands for ore increased, our handling and general charges have shown a corresponding drop. The end of the year finds us in a position to greatly increase our output and to deliver it at a lower cost per ton.

The shipments totaled 477,435 dry tons of ore. Of this amount 314,043 tons were from the heavy sulphide No. 1 orebody, and 163,392 tons were from the more siliceous No. 2 orebody. The tonnage of ore from the two bodies demanded by the smelter became, towards the end of the year, practically equal, proving that these bodies can be smelted in their developed tonnage proportions. This adds distinctly to the value of the mine.

The copper content in the ore has been 2.18 per cent., with a gold and silver content valued at 34 cents per ton. The monthly ore shipments, during the entire year, have analyzed higher in iron and sulphur, lower in silica and alumina than the average estimated for the orebodies.

The mining costs for the twelve months have been $1.03 per dry ton landed in the cars on the railroad to the smelter. This amount includes the handling of 29,310 tons of waste, and a development charge of 10 cents per ton. The period has been one in which we have absorbed many charges which would more exactly belong to equipment and capital accounts. The wages paid to employees have been increased in proportion to the market price of copper. This has amounted to 50 cents per man shift, or 7 cents a ton, for the last two months. The costs for the last six months, exclusive of this bonus, have been 80 cents per ton. Basing our estimate upon the actual conditions and upon the results obtained during the year, with wages and supplies at the level they have averaged during the past three years, future mining costs of 81 cents a ton are attainable upon the completion of some improvements now in process of being introduced.

The further exploration of the mineral area by diamond drilling in and surrounding the mine was not attempted during the year. The ore reserves, with the deductions of shipments, remain at practically the same figures as reported for the previous year. To the reserves of the Hidden Creek mine should be added at this time the developed tonnage at the Bonanza mine. The latter mine is also in the immediate vicinity of the smelter and can be handled under the same organization. The following is then a summary of our ore reserves tributary to the smelter at Anyox:

	High Grade		Low Grade		Total	
Hidden Creek...	9,205,837	2.17	8,628,000	0.63	17,833,837	1.43
Bonanza	414,775	3.46	489,580	0.70	904,355	1.6
Total	9,620,612	2.19	9,117,580	0.63	18,738,192	1.45

The development work has consisted of 1,204 feet of drifting and cross-cutting with 1,732 feet of raising; a total of 2,936 linear feet. The greater part of the work was done on the 385 level in the further blocking out of the No. 1 orebody on this plane. Two new ore passes, one having a capacity of 5,000 tons of broken rock, were driven between the 385 and 530 levels and were among the important pieces of development. Sufficient work was done to make the No. 4 orebody, which is the heaviest sulphide orebody in the mine and valuable as a flux at the smelter, available for shipment. The development work in many cases, especially in the No. 1 orebody, encountered ore of higher grade than would be expected from our previous exploration.

Considerable construction was completed, including a new bunk house, additional cottages and a substantial electric sub-station. There is at the present time in process of erection a second crusher station and ore bins, which will enable us to introduce a more economical system of crushing and shipping. This plant also makes possible a large additional storage of crushed ore. The storage is much needed in order to more closely approach the ideal condition of handling with our mine haulage a fixed number of tons a day. We are now mining and shipping at the rate of 2,000 tons a day, which is our designed output. This we expect to increase to average 3,000 tons a day upon the blowing-in of the recently added fourth smelting furnace.

There has been a gain during the year in the personnel of the employees and in their efficiency in their places. Due credit should be given to all for their interest in the work, through which we have been able to successfully meet many unusual conditions.

The daily shipments have been very irregular in their bulk, through depending on two uncertain factors which controlled the ore demands. These were the metallurgical difficulties in smelting and shortage of power. The former were continually being eliminated, while the latter is a seasonable factor during the winter months that is still to be encountered. To control erratic shipments there was not ample storage capacity between the mine and the smelter to give either protection. The mine difficulties of an internal nature, as crusher troubles for example, have not at any time prevented the shipment of sufficient ore to keep the furnace in blast.

The amount of ore drawn from each mine chute is tabulated on the daily reports. In this manner the amount of ore drawn from the different orebodies, and portions of the bodies, is at all times under supervision. The character of the shipments can be determined and controlled as much as it is possible in the system of mining employed.

Of the ore shipped, 66 per cent. was from the No. 1 orebody, 34 per cent. was from the No. 2 orebody, while no shipments of any amount were made from the No. 3 and No. 4 orebodies, although they are developed for shipment. The No. 1 ore was mined mainly above the 530 level, 77 per cent. of the ore coming from here, while 23 per cent. was mined between the 385 and 530 levels. The No. 2 ore was mined mainly from the 530 and 700 levels; 40 per cent. coming from above the 700 level, 14 per cent. from between the 630 and 700 levels, 38 per cent. from between the 530 and 630, while 8 per cent. came from below the 530 level.

The smelter asked for a further classification of the ore during the year. This involved the screening of the fines from the ore; the selection of the heaviest sulphides from the No. 1 orebody; the shipment of siliceous material from the hanging wall of this body, of sacked granular pyrite and of clean pyrrhotite. The two latter came from the surface of the mine hill. These special lots and demands necessitated further outlays in construction, development, alteration and operation to make possible their shipment. They have been discontinued for several months. The ore now shipped is nearer the run of the mine ore in equal proportions from the main orebodies.

The content of the ore in copper, lime and magnesia is very close to the estimated normal. Ore of a low siliceous and heavy sulphide nature has been in demand. We have been able to supply No. 1 ore averaging 4.6 per cent. and No. 2 ore averaging 6.3 per cent. under the estimate in silica, with the sulphur and iron content high and the alumina content low in percentage. This has come through being able to stope in the centre of the bodies rather than along the walls. This condition cannot be regarded as being capable of being maintained in the future, if full advantage is to be taken of the full tonnage in the mine.

With the alteration of the shipping terminal and the building of the second crusher station completed, there will be an ore storage of 6,000 tons above the shipping tunnel. The shipments of ore will thereby be severed from their dependency on the crushing and mine haulage. The train loading which now takes two shifts, can be done on one shift by a loader and two helpers. This takes for granted the supply of a sufficient number of railroad cars.

The haulage throughout the mine is accomplished in self-dumping steel cars of 3.7 tons capacity, hauled by 6-ton locomotives. The locomotives carry headlights of unusual capacity as an aid to the safety of the men and to the ease and safety of the haulage. The switches on the main lines are protected by colored switch lights. This account does not vary directly as to the tonnage, as a variation in the tonnage may signify a train which is not working at its full efficiency. A uniform gauge of two feet, laid with 30-lb. rail is used in all the tunnels and drifts.

There has been considerable alteration and repair work on the cars in excess of that expected in the daily haulage. The maintenance on cars of this type for the duty they will have on our main haulage tunnels (especially if the tonnage is increased) will be severe.

In the first two months of the year ore was crushed and belt conveyed to the shipping pockets. The next month began to develop conveyer troubles and two breaks occurred through inferior steel in the sectionalized Traylor crusher. The second break was serious enough in its effect to leave the plant without a crusher in the next four months. In this time, 169,000 tons of ore were broken by block-holing, bull-dozing and sledging on 90-lb. rail grizzlies having 14 in. spaces. The crusher was restarted in February with the belt-conveying of ore entirely eliminated.

The only timber utilized in the mine is that used in the construction of chutes on the sill floors. These chutes are substantially built in the rock collar of the raises to withstand bull-dozing at the gates without great damage. Where expected to withstand exceptionally heavy duty, the chutes are lined with steel plates, and an iron finger gate operated by an air lift is used instead of the usual type are gate. Three hundred and fifty-nine chutes have been repaired during the year and 11 new chutes built. The size of the timber crew has to be sufficient to undertake at any time the maximum

repair work. It is possible to keep enough work ahead in chute building and trestle work so that the crew has work blocked out in advance.

The introduction of carbide lamps to replace candles has resulted in a considerable saving in lighting. Each man furnished his own lamp, while the company furnishes the carbide.

The mine is electrically lighted on all main haulage ways.

The development work consisted of 1,204 feet of drifting and cross-cutting with 1,732 feet of raising and sinking—a total of 2,936 feet. About half of this work was done on the 385 level in continuing the blocking out of the No. 1 ore body. Two pocket raises were driven between the 385 and 530 levels; one in each of the two orebodies. The raise in the No. 2 orebody greatly improved the ventilation throughout the 385 level. The No. 4 orebody was developed by driving the 700 ft. adit beneath the body and raising until it was encountered. The year completes the greater part of the development work needed on the ore above the 385 level.

Our estimates given on July 1st, 1914, were very carefully checked during the year by two mining engineers, Mr. C. M. Weld and Mr. F. B. Weekes. The latter gentleman has also checked the estimates on a former occasion. They obtained at the Hidden Creek mine a tonnage of 8,992,275 tons of 2.14 per cent. ore in comparison with our estimate of 9,563,500 tons of 2.17 per cent. ore. This can be considered, under the conditions, a close agreement. We still consider our estimate, on account of close association with the development of the orebodies, as nearer the exact tonnage. Their sampling in the mine arrived at very close figures to those we had obtained at the same points.

The results which they obtained on Bonanza were to estimate practically the same tonnage while reducing the copper content from 2.78 to 2.30 per cent. This was done by the inclusion of waste rock in the form of dykes, which we had omitted in our calculations. These dykes form here about 12 per cent. of the bulk of the developed orebody. Taking into account their highly siliceous and aluminous character, it will be doubtful if they can be smelted with the ore. They will have to be sorted from the ore either in the mining or by selection outside the mine. Therefore in this case we also consider the more exact of the two estimates to be the one made at this office.

The ore estimates remain practically at the same figure this year as last, as no endeavor has been made in the interval to put more ore in sight.

The value of the Bonanza claims as addition to the reserves of the Hidden Creek mine, tributary to the smelter at Anyox, has not been sufficiently emphasized in the former reports. This group of claims is located on Bonanza creek, which flows into Granby bay about two miles from the company's dock. The claims lie in the creek valley three-quarters of a mile from the mouth. The distance from the orebody to the smelter in a direct line is 10,000 feet; in a line following Bonanza creek to the mouth and from there to the smelter, 14,000 feet. The method of haulage adopted, whether aerial, train or railroad, will vary the distance the ore will have to be carried to the smelter between the given limits.

It is said that the control of the Planaurum property in the Porcupine district will be sold to the La Rose Mining Company. The directors of Planaurum Mines, Ltd. are reported to favor the sale of 50,000 shares of unissued stock remaining in the treasury at about $1 per share.

A FRENCH VIEW OF THE WELSH STRIKE

The "Colliery Guardian" publishes the following metrical translation of a poem by an eminent French poet which has attracted much attention, as showing what our French comrades think of some recent events in South Wales. M. Liseron himself, it is interesting to observe, is an advocate of advanced views on the labor question. The author of the translation is a well-known British mining engineer, who prefers to retain the cloak of anonymity.

THE WELSH MINERS

[Translation of verses by M. Paul Liseron, the original of which is published in "The Morning Post," September 29th, 1915.]

Who, miners of Wales, do you think that you are
That you set yourselves up above all laws of war
Of duty, of justice, and even humanity?
What egregious conceit, impudence and vanity!
When your brothers are fighting for right and for freedom
You force up your wages you really do bleed them.
When good British life-blood is soaking the earth
To safeguard your homes and the land of your birth:
When Britain is calling on each of her sons,
To go forth and vanquish the Vandals and Huns,
Do you miners of Wales take the side of their foes,
The most brutal and cruel, as all the world knows?
Have you no other care but inordinate greed
And your unions promote such base interests indeed?
Oh, list to the groans of your brothers who fall
In the midst of the battle by shrapnel or ball!
Contemptible wretches! 'tis you who for pence
Commit crimes such as these—'tis a felon offence
The Allies are fighting the foes of your class;
They are striving to subjugate all the whole race
You miners, 'tis you who your brothers betray;
'Tis you who are giving your comrades away.
May the shillings you've won burn your fingers, that you
The base bargain you've made in a bad day may rue.
If I had my will, I would send you to share
The dangers your comrades are facing out there
In the trenches, where hailstorms of bullets and bombs
Are sweeping in thousands our men to their tombs.
If a soldier deserts he is usually shot:
And that's what you merit, you grimy-faced lot,
For you're so closely in touch with the foe
And the laws of war all the world over, you know,
Make the penalty death; and therefore it's great
That something like that may yet be your fate.
Liberty knows to God's retribution, though ample
Avails you, you ought to be made an example;
Your punishment should be severe, for the mud
Of the battlefield's soaked with your countrymen's blood.
I know that amongst you false prophets there are
Who advise you to make your hay during the war.
You've injured your country and Allies right sore,
But you've injured yourselves and your calling still more.
Bad shepherds you have, but the sheep are bad, too:
The flag is dishonored by fellows like you!
Your mine's banner will never again
Be clean: 'tis disgraced by so nasty a stain.
For ever and ever that stain to remind you,
You saw Edith Cavell on the dock without shame
And that stain is for you a symbol of death;
You miners of Wales think of Lady Macbeth.
Like her on your hands there is blood; and you ne'er
Can wash it away—it will always be there.
The damnation of Judas is yours
Who sold his dear Lord, and his sin still endures.
Do not remember, my friends, you will yet
Requite those who duty and honor forget.

The finger of scorn [illegible] you'll despise.
You have bartered your honour, you've sacrificed right

KERR LAKE MINING COMPANY, ANNUAL REPORT

President Adolph Lewisohn reports: During the year ending August 31st, 1915, the Kerr Lake Mining Co. produced 2,036,962 ounces of silver. In spite of the fact that a larger percentage of the production was derived from low-grade ore, the total cost per ounce was considerably lower than for the previous year. This was principally due to the marked reduction in the cost of mining, from $5.09 to $4.15 per ton. Due to the lower price of silver the total earnings were somewhat less than last year.

On July 15th, the company acquired a majority interest in the Caribou Cobalt Mines Co., which controls 70 acres adjoining the Kerr lake property.

Manager Robert Livermore reports:

The gross production from all ores, for the year ending August 31st, 1915, amounts to 2,036,962 oz. of silver. This figure includes 60,842 oz. of silver on hand August 31st, 1915, according to inventory. Of the total, 1,198,-557.16 oz. was produced from shipping ore, and 838,-405.38 oz. from low-grade ore milled by the Dominion Reduction So., Limited, at Cobalt.

Ore Production, Kerr Lake Mining Co., for the Year Ending August 31st, 1915.

Grade of ore.	Net weight, pounds.	Silver contents, ounces.	Average silver content per ton, ounces.
1st class	564,273	954,112.37	
Bullion from 1st class		126,802.04	3,831.24
2nd class	238,606	103,501.68	867.55
Bullion from metallics		14,141.07	
Mill ore	23,035 tons	838,405.38	36.396
		2,036,962.54	

Development.—Including drifting, cross-cutting, sinking and raising, 4,226.1 ft. was done in development for the year. This compares with 5,399.5 ft. for last year. The decrease in footage was caused by temporary shutdown of No. 3 shaft, and to the fact that there were fewer long drives in which uninterrupted progress could be made. Although a great deal of exploratory work was done in hitherto unprospected blocks, there were few new discoveries of importance during the year. In consequence additions to the reserves were made only through extending the developments on known veins.

Developments given in more detail are as follows:

No. 3 Shaft.—Drifts were extended east and west on the Keewatin vein and its branches on the 6th level, but no new ore was found. Owing to the fact that a small but rich ore pocket was found on this level last year, and that the vein was wide and well mineralized, it was decided to prospect at deeper levels in the Keewatin formation below the diabase contact. Accordingly a winze was started, and has to date been sunk to a depth of 64 ft. The 7th level at 50 ft. below the collar, and 370 ft. in all below the collar of No. 3 shaft, has been driven east and west 74 feet. Although the vein is still strong, and contains a quantity of smaltite, it has shown only low-silver values. From this same vein at the 2nd level of No. 3 shaft, a long cross-cut was driven through the south central part of the property directly to the south boundary. This cross-cut is in diabase formation, and has exposed no new veins for its entire 450 ft. in length. The results of this work make it seem unlikely that new ore bodies will be found in this part of the property.

Owing to the advisability of cutting off the high expense of operating during the winter months No. 3 shaft was closed, and development of this section has accordingly been slow. The open headings have now been housed in as a protection against freezing, and it is expected to do continuous development at depth on the Keewatin vein during the coming year.

No. 7 Shaft.—The largest amount of development on the 140-ft. level was done on the Fleming and Lake No. 3 vein systems in opening up their extensions and branches, with the result that enough ore was put in sight nearly to maintain the reserves of milling and high grade ore in these veins in spite of the past year's production. A notable discovery was made on the Fleming vein in particular, where a cross-cut north, opened up a branch not known before, which was drifted on for 186 ft., and contained at the level ore averaging 350 oz. over 6.3 inches in width, beside the usual width of milling rock. The distance between the level and the lake bottom is small, and so far the ore has not been found to extend to the 190-ft. level, the next level below. On Lake vein No. 3 extensions on the 140-ft. level did not open much ore beyond that discovered last year, but on the 175-ft. level, drifts showed that the values although spotty and not continuous extended to this depth.

Other drifting in No. 7 shaft opened nothing of great importance. An intermediate on No. 7 vein below the 175-ft. level, opened a small body of milling rock and second grade ore. An intermediate on No. 10 vein below the 140-ft. level extended the orebody for 50 ft.

Cross-cutting has become more a feature of the development, and drifting less, owing to the fact that the known veins have been followed out by drift to their full extent. The larger part of development work in the future will undoubtedly consist of cross-cutting unprospected blocks, especially in the more favorable Huronian formation.

Developments for the coming year will include thorough prospecting of this nature. Further development at depth of the Keewatin vein will be done, and a winze will be sunk on No. 10 vein, where at the lowest level the vein is still strong, though barren of value.

Stoping was evenly distributed over the mine, and the veins taken as a whole produced ore well up to the estimated contents for the ground removed.

The largest amount stoped in any single vein was in the Fleming below and for a distance of 28 ft. above the 225-ft. level, where the entire block was stoped and the level covered in. Eleven thousand nine hundred and eleven square feet was stoped which produced 3,000 tons of average grade mill rock, and 38,000 oz. of high grade ore. This block is of lower grade than those above. No stoping has been done above this point, and a better proportional production of both high grade and mill rock may be expected.

The Main East vein was stoped 8,622 sq. ft., through to surface, over a distance of 150 ft., under the former lake bottom, and the opening was covered over. This vein has produced handsomely both in high grade and mill rock, and still contains an excellent reserve of both broken rock and ore in place.

No. 10 vein was stoped for 4,564 sq. ft., mostly above the 140-ft. level. Production of both high grade and mill rock has been good, as the ore zone is from 10 to 40 ft. wide, and contains many stringers of high grade ore.

Production from the old reserves, No. 7 and the Big Chamber, was well maintained, and although it was expected to finish these reserves during the year, a very considerable amount still remains.

On No. 218 vein production was somewhat lower than was expected, as this vein became barren after being stoped for a distance. A side vein has recently been opened up which may make up the estimated contents.

A cutout stope on No. 3 Lake vein produced 49,559 oz. of high grade ore.

Two thousand five hundred and seventy tons of ore was drawn from No. 3 dump. The average grade of this rock after sorting was 30.9 oz. per ton.

One thousand three hundred and fifty-four tons was drawn from No. 7 dump, but owing to a shutdown in the mill 1,673 tons was added, so that the dump has gained 319 tons.

Total Development and Stoping—September 1st, 1914, to September 1st, 1915.

	Development.	Stoping.
Drifting ft.	1,996.2	
Cross-cutting ft.	2,103.4	
Raising ft.	59.3	
Sinking	67.2	
Stoping sq. ft.		48,223
Total	4,226.1	48,223
Trenching	112.0 ft.	

Production of Individual Veins, Kerr Lake Mine, for the Year Ending August 31st, 1915.

Vein. system.	Development oz.	Stoping oz.	High grade total production oz.
Big Chamber		173,944	173,944
Fleming	24,505	38,116	62,621
No. 7		213,929	213,929
Main East		289,457	289,457
No. 10		266,807	266,807
No. 8		33,936	33,936
McDonald		72,994	72,994
No. 3 Lake	5,412	49,559	54,971
Little No. 3		3,091	3,091
No. 218		19,620	19,620
Little No. 7		7,187	7,187
Total	29,917	1,168,640	1,198,557
Mill ore			838,405
Grand Total			2,036,962

Ore Sorting and Jigging Plant.—Undersize from the mill was jigged as usual, but no production from this source is listed, since experiments made last year showed that it was advisable to sort the products and add some to the first and second grade shipping ore. Tailings and fines from this plant are of milling grade, and are shipped to the mill. An experimental settling tank was put in the lake bottom to catch the waste water containing a small proportion of slimes. The results show that this saving is worth while, and a larger tank is now being installed.

The machine shop, consisting of lathe, shaper, hack-saw, and emery wheel, installed last year, is operating satisfactorily, and results in a considerable annual saving in time and expense for all kinds of repairs and machine parts.

A pot melting furnace was installed during the year to melt into bullion the rough metallics from the mine and the fall-off oversize from the sampler. These products were formerly custom melted.

Production of mill ore was 206,382 gross ounces higher than last year, owing to increased milling facilities and slightly better grade of the ore, namely 36.40 oz. this year against 33.83 oz. per ton last year. Of the 23,035 tons sent to the mill, 2,199 tons was taken from the dumps.

Mining Cost Per Ton of Rock Hoisted—September 1st, 1914, to August 31st, 1915.

			Tons.
Tons rock hoisted, 47,436.	Ore, 38,286 tons.	Sacking ore—	
		1st grade	282
		2nd grade	119
		Total	401
		Mill ore	20,836
	Mine Waste 9,150 tons.	Waste from bumping table	17,049
		Total	38,286

The following were the costs: 47,436 tons rock hoisted at a mining cost of $4.15 per ton; 2,036,962 silver ounces at a mining cost of 9.67 cents per ounce.

Lake Draining.—During the year it was found by sounding that a deeper and larger drainage basin existed somewhat to the east of the then location of the pump scow, which by removal of the clay overburden would be available for a better sump than that in use. Accordingly the 20-inch pipe line was shifted and extended, and during the present summer work has consisted of breaking down and pumping out the clay from this drainage area. This has now been finished, and during the coming month a smaller pump unit will be installed to keep the basin free of water, since the large pumps are no longer needed.

Drummond Fraction.—This property was worked under separate organization until August of this year, when the only known vein having been worked out and developments to date having disclosed no new ore, in order to do away with top expense, the shaft was closed down. Future developments will be carried on from the adjoining workings of the Crown Reserve and Kerr Lake properties.

The Drummond produced during the year 3,756 tons of mill rock, averaging 24.7 oz. per ton. Besides this 37,918 oz. of high grade was produced, and 11,240 lb. remaining on hand contains by assay 19,600 oz. of silver, so that the production of this property in gross ounces of silver is 150,462 oz. for the fiscal year.

Ore Reserves.—Although no important new reserves were added, estimates this year show a diminution of 1,526,300 oz. as against 2,036,962 oz. produced. This is owing to additions to the known reserves above named, and, in some cases, to excess of production over estimated contents. Although owing to the extreme irregularity of the orebody it is not practicable to measure accurately the tonnage of mill rock, an attempt has been made to do so by means of measurement and past production, which can be considered a reasonably close approximation.

Although as in the past the estimates both of high grade and mill ore are liable to variation, either above or below the estimated contents in the separate veins, yet there can be no doubt but that the eventual production taken as a whole will reach the figure given.

Prospects of opening new ore do not seem at the present time very bright, as the lake bottom has been well explored, and the blocks remaining unexplored are all small. Developments in the diabase and keewatin formations in the south half of the property have so far not been encouraging, since only small patches of ore on the Keewatin and No. 21 veins have been found. Nevertheless, the Keewatin vein is very strong

and regular, and it is hoped that further developments both in sinking and raising will open other ore.

An estimate of ore in reserve follows:

Estimate of Ore Reserves, Kerr Lake Mine, September 1st, 1915.

Vein system.	Estimated oz. high grade.	Milling ore. Tons.	Gross ounces	Total estimated ounces. of silver.
Big Chamber, McDonald and No. 7 veins	895,000	4,000	112,000	1,007,000
Main East, No. 218 veins	248,700	2,500	50,000	298,700
No. 10, No. 15, Xmas veins	788,300	12,290	407,250	1,195,550
No. 8 vein	31,400	1,500	22,250	53,650
Little No. 7 vein	8,000	540	13,500	21,500
Lake No. 3 and Fleming veins	620,000	22,000	686,000	1,306,000
Other veins	5,000	2,000	35,000	40,000
Dump ore	.....	10,000	250,000	250,000
Total	2,596,400	54,830	1,576,000	4,172,400

Average value per ton milling ore 29.3 oz.

Treasurer E. H. Westlake reports:

The shipments for the year amount to 1,992.065 gross oz. The smelter settlements aggregate 1,777,122 oz. The difference is accounted for by the deductions made by the smelting works for losses and in the way of treatment charges.

The costs of production per ounce are as follows:

	Cents.
Mining and development cost	9.67
Shipment and treatment charges	11.09
Administration and general	0.69
Total	21.45

There has been included in development expense the sum of $18,049.68, expended in connection with Kerr Lake-Crown Reserve Drainage Account, leaving a balance of $27,900.32 in the Drainage Account, as at August 31st, 1915. There has also been written off against the cost of property acquired in connection with the lake drainage, the sum of $24,589.35.

On July 15th, 1915, the Kerr Lake Mining Co. purchased 837,400 shares of the Caribou Cobalt Mines Co. (out of a total of 1,000,000 shares) for $50,000.

All construction expenditures during the year have been charged to operation expenses, under the heading of "Repairs to Plant and Buildings."

The total amount of dividends paid by the company to August 31st, 1915, is $5,820,000.

Kerr Lake Mining Co., Limited—Operating and Profit and Loss Account for the Year Ended August 31st, 1915.

Cost of production and development—		
Stoping	$17,977.32	
Development	40,074.10	
Power, light and heat	26,208.77	
Ore sorting and jigging	11,688.92	
Tramming	20,023.28	
Hoisting	6,543.12	
Timbering	16,854.20	
Pumping	920.55	
Drills and steel	6,395.08	
Mine expense	10,492.31	
Repairs to plant and buildings	3,185.78	
Stable expense	4,657.79	
Office expense	4,805.35	
Surface maintenance	7,398.18	
General expenses	1,041.45	
Taxes	18,739.21	
Boarding house	72.44	
		$197,077.85
Shipment, treatment and other charges—		
Shipment expense	$1,037.23	
Milling	3,891.08	
Freight	5,746.67	
Ore treatment expense	100,895.23	
Assaying	3,498.36	
Insurance	4,842.78	
		119,911.35
Administration and general expense—		
Mine manager's salary	$8,400.00	
Directors' fees	600.00	
Traveling expenses	330.20	
General expenses	4,834.82	
		14,165.02
Amount written off cost of property acquired in connection with lake drainage	$24,589.35	
Exploration on outside properties	1,501.00	
		26,090.35
Balance transferred to Profit and Loss Account		550,774.19
		$908,018.76
Proceeds of ore sales	$893,375.46	
Less: Ore on hand, at smelter and in transit, August 31st, 1914, at estimated value	108,180.38	
	$785,195.08	
Plus: Ore on hand, at smelter and in transit August 31st, 1915, at estimated value	104,818.37	
		$890,013.45
Interest		18,005.31
		$908,018.76

Kerr Lake Mining Co., Limited—Balance Sheet, August 31st, 1915.

Assets.

Mine property	$104,178.70
Buildings, plant and equipment	33,351.21
Inventory of materials and supplies	7,913.78
Ore on hand, sold and in transit, unsettled for, at estimated value	104,818.37
Bank interest accrued	868.49
Unexpired insurance	2,122.14
Sundry debtors	749.85
Cash	265,777.55
Short term bonds	355,154.00
Kerr Lake-Crown Reserve drainage account	27,900.32
Kerr Lake Mining Co. of New York	58,000.00
	$958,876.41

Liabilities.

Capital stock: 400 shares at par value of $100 each	$40,000.00
Accounts payable	6,673.64
Accrued wages	7,688.71
Reserve for accrued taxes	13,564.34
Reserve for outstanding liabilities	2,500.00
Surplus—	
Balance September 1st, 1914	$961,093.94
Profit for year ended August 31st, 1915, as per Operating and Profit and Loss Account	550,774.19
	$1,511,868.13
Deduct: Dividends paid during the year	620,000.00
	$891,868.13
	$939,876.42

Kerr Lake Mining Co. of New York—Income and Expenditure Account for the Year Ended August 31st, 1915

Administration and General Expenses—		
Legal	$3,026.98	
Taxes	292.43	
Officers' salaries	6,500.00	
General expenses	4,774.59	
Directors' fees	1,160.00	
Engineers' services	2,500.00	
		$18,254.00

United States internal revenue		5,909.39
Dividends paid during the year, as under—		
No. 36, paid September 15th, 1914	$150,000.00	
No. 37, paid December 15th, 1914	150,000.00	
No. 38, paid March 15th, 1915	150,000.00	
No. 39, paid June 15th, 1915	150,000.00	
		600,000.00
		$624,163.39
Dividends received from the Kerr Lake Mining Co., Limited		$620,000.00
Interest		534.06
Balance to Balance Sheet		3,629.33
		$624,163.39

Kerr Lake Mining Co. of New York—Balance Sheet, August 31st, 1915.

Assets.

Kerr Lake Mining Co., Limited, of Ontario, Canada: Shares acquired in consideration of issue of capital stock of this company per contra	$3,000,000.00
Wettlaufer Lorrain Silver Mines, Limited: 150,000 shares at 15 cents per share	22,500.00
Kerr Lake Majestic Mines: 200,000 shares at cost.	79,548.37
Caribou Cobalt Mines Co.: 837,400 shares at cost.	50,000.00
Cash	3,665.88
Accrued interest	53.48
Sundry debtors	75.00
	$3,155,842.73

Liabilities.

Capital stock: 600,000 shares at $5 each fully paid		$3,000,000.00
Reserve for outstanding liabilities		1,250.00
Kerr Lake Mining Co., Limited		58,000.00
Sundry liabilities		140.00
Unclaimed dividends		1,485.10
Profit and Loss Account—		
Balance September 1st, 1914	$98,596.96	
Less: Transfer from Income and Expenditure Account	3,629.33	
		94,967.63
		$3,155,842.73

CANADIAN MINING INSTITUTE

A regular meeting of the Toronto branch of the Canadian Mining Institute was held at the Engineers Club on October 30th.

Among the guests were Mr. W. F. Green of Crystal Falls, Michigan; H. W. Hardinge of New York; R. J. Ennis, superintendent of McIntyre-Porcupine mines; and Prof. Ledoux, formerly of the University of Brussels, and now on the staff of the mineralogical department of the University of Toronto.

Prof. Ledoux who took part in the early struggles of the brave Belgians against the German invaders gave a very interesting talk on the subject now of most interest to all of us. He spoke highly of the sympathy shown for his people by the Allies and by Americans.

Mr. Hardinge, who has recently visited many mining districts in United States and Canada, talked of the great progress being made by the flotation process. He pointed out that in many districts the flotation process is increasing the percentage recovery of values and decreasing the cost. He predicted successful treatment of the waste sand and slime from the mills at Cobalt.

Mr. Ennis gave some account of the progress at Porcupine. He stated that most of the companies are making arrangements to greatly increase their milling capacity. He is very much in favor of using ball mills instead of stamps, stating that the Porcupine gold ores are so readily fractured into small particles that much better results are obtained by the mills than by stamps.

Mr. Green, who has been connected with the development of an iron mine on the Gogebic range, Michigan, gave some account of the discovery and opening up of the Wakefield iron deposits.

The following were appointed an executive committee for the coming year: C. E. Smith, Robt. Bryce, W. E. Segsworth, D. A. Dunlap, Wm. McNeil, H. E. T. Haultain and T. F. Sutherland.

The next meeting is to be held at the Engineers Club, Saturday, Nov. 20th, at 1.15 p.m.

Mineral Court, Canadian Pavilion, Panama-Pacific Exposition

SCENES IN MICHIGAN COPPER COUNTRY

Regrinding Ore, Pouring Copper, and Refining Copper Electrolytically.

SCENES IN MICHIGAN COPPER COUNTRY

View around Shaft-houses, Calumet and Hecla Mines.

PERSONAL AND GENERAL

Mr. L. K. Armstrong, of Spokane, Washington, secretary-treasurer of the Columbia section of the American Institute of Mining Engineers, has convened a meeting of the section, to be held at Wallace, Idaho, on November 19 and 20. Several members of the A.I.M.E. resident in Kootenay or Boundary districts of British Columbia will join the excursion party to leave Spokane on the morning of the 19th. The Montana section of the Institute has been invited to attend and take part in the proceedings. The Western Branch of the Canadian Mining Institute will be represented by its secretary, who is one of the invited guests.

Mr. John Bresnahan, of Spokane, is superintending the development of the Galena Farm mine, near Silverton, Slocan lake, B.C., in which two veins of zinc-lead ore are being opened to supply feed for the newly-erected concentrating mill on the property, which was to be started early in November.

Mr. M. S. Davys, managing director of the Silverton Mines, Ltd., operating the Hewitt mine and concentrating mill near Slocan lake, B.C., went to East Kootenay last month to spend a week on a shooting trip.

Mr. Ivan De Lashmutt, superintendent of the Standard silver-lead mine, in Slocan mining division of British Columbia, returned to the mine late in October from a visit to Spokane, Washington.

Mr. R. C. D. Dempster is mining engineer at the Cork-Province mine, on the south fork of Kaslo creek, in Ainsworth mining division of British Columbia.

Mr. J. Cleveland Haas, of Spokane, is consulting engineer for the syndicate that last month commenced to do development work on the Nicollet mineral claim, near Ainsworth, West Kootenay, B.C.

Mr. C. H. Hussey, of Spokane, who is active in the business management of the Standard silver-lead mine and concentrating mill, at the end of October was a visitor to the property which is situated near Silverton, B.C.

Mr. Robert Keffer, son of Mr. Frederic Keffer, formerly of Greenwood, in Boundary district of British Columbia, is now at one of the mines at Butte, Montana.

Mr. John Keen, of Kaslo, Kootenay lake, B.C., well known to many mining men in that province, has been ill with bronchitis, but is now convalescent.

Mr. I. Krikin is superintendent at the Payne silver-lead mine, near Sandon, Slocan district of British Columbia, at which mine important development work has been in progress for some time past.

Mr. Andrew G. Larson, left British Columbia at the end of October to proceed to St. Louis, Missouri, on business connected with the sale of the zinc product of the Lucky Jim mine, in Slocan district.

Mr. A. W. McCune, of Salt Lake City, Utah, was again in British Columbia at the beginning of November, investigating conditions with a view to again working mining properties in which he is interested and which are situated in Ainsworth and Slocan divisions of that province.

Mr. Frank E. Pearce is manager for the company operating the Eureka copper-gold mine, situated about a dozen miles from the town of Nelson, British Columbia. At one time Mr. Pearce was engaged in mining at Baker City, Oregon.

Mr. F. E. Pegg, who several years ago was on the British Columbia Copper Co's assay office staff, is now assayer and surveyor at the Galena Farm mine, near Silverton, B.C.

Mr. F. C. Poss, of New York, president of the Mountain Con. Mining Co., and secretary-treasurer of the Minnesota Silver Mining Co., Ltd., which latter company owned the Ivanhoe concentrating mill at Sandon, Slocan, destroyed by fire last August, has been visiting British Columbia in connection with the adjustment with the insurance companies concerned in the loss that resulted from the fire.

Mr. W. S. Rugh, for years office manager for the Le Roi Mining Co. at Rossland, B.C., will shortly proceed to Toronto, where he will be sales agent for the Consolidated Mining and Smelting Company of Canada, Ltd. Recently he was in the Coeur d'Alene district, Idaho, arranging for a change in the accounting system of a mining company operating there on a large sacle.

Mr. Chas. Simkins, mine superintendent for the Florence Mining Co., which has been engaged during the last two or three years in opening a silver-lead mine on Princess creek, near Ainsworth, B.C., is arranging to pay a visit to Spokane, Washington, and the Coeur d'Alene district, Idaho.

Mr. Alex. Smith, for years manager of the Surprise mine, in Slocan mining division, B.C., has been on a visit to the Coast cities of that province.

Mr. A. D. Wheeler, of Ainsworth, B.C., has been engaged in sampling the Comfort mineral claim, a lead property lying adjacent to the Bluebell nine, near Riondel, on the east shore of Kootenay lake.

Mr. Oscar V. White, manager of the Slocan Star mine and concentrating mill, near Sandon, Slocan, B.C., has been on a visit to Vancouver, for the benefit of his health.

Mr. George W. Wooster, of Vancouver, B.C., one of the directors of the Granby Consolidated Mining, Smelting, and Power Co., Ltd., was in Nelson late in October, to attend a meeting of mine-owners and managers, called to discuss matters of more than ordinary importance to mining companies and other industrial organizations.

Mr. W. E. Zwicky, of Kaslo, B.C., manager for the Cork Province Mines, Ltd., operating in Ainsworth mining division, has been ill in bed, but at last advices he was recovering.

Mr. Bert N. Sharp, at one time assayer and surveyor at the First Thought gold mine at Orient, Washington, owned by Mr. P. Burns and associates, recently left Republic, Washington, for Shamut, California, where he will be assistant superintendent of the Eagle-Shamut mine. After leaving Orient several years ago, Mr. Sharp was interested in mining property in Sheep Creek camp, in Nelson mining division of British Columbia; latterly, however, he had been engaged in connection with the operation of mines in Republic camp.

Mr. B. M. Snyder, who several years ago was chief chemist and afterward smeltery superintendent for the British Columbia Copper Co. at Greenwood, B.C., whence he went to California, recently examined several mining properties in West Kootenay for United States principals. With Mr. George Crerar, who was chemist and assayer at the Boundary Falls copper smeltery during the later activities of that establishment, Mr. Snyder is now engaged in working out a zinc-reduction process at Victor, Colorado.

Mr. Jules Labarthe, for a number of years superintendent of the Consolidated Mining and Smelting Co. of Canada's copper and lead smelting works and electrolytic lead refinery at Trail, B.C., and afterward general manager for the Mason Valley Mines Co. in Nevada and Utah, revisited Trail late in October having gone there from the Coeur d'Alene district of Idaho where he had been in connection with the intended establishment of reduction works for one of the big mining companies operating in that district. Mr. Labarthe is now a member of an engineering firm having its headquarters in San Francisco, California.

Announcement has been made by several Washington State newspapers to the effect that the smeltery at Northport, Washington, on the railway lines between Nelson and Rossland, in British Columbia, and Spokane, Washington, will be ready for operation by January 1st next. The smeltery has been acquired by Coeur d'Alene mining men from the Le Roi Mining Co., Ltd. (in liquidation), and is being thoroughly renovated and improved, among the improvements being the addition of lead stacks and the overhauling of several of the copper blast furnaces. While present preparations are only for the smelting of a few hundred tons each of lead and copper ores, it is planned to eventually enlarge the treatment capacity of the works to 3,500 to 4,000 tons of ore a day.

Mr. Robert Bryce left Toronto last week for Montana.

Mr. H. W. Hardinge was in Toronto two weeks ago.

The 1916 annual meeting of the Canadian Mining Institute will be held in Ottawa March 1, 2, and 3.

Lieut. Alex. Smith, formerly in charge of the Teck-Hughes mine in the Kirkland lake district and now recruiting in Northern Ontario for the Pioneers, is meeting with great success.

Mr. J. A. Wookey, of the staff of the Canadian Mining and Finance Company is sampling the Wright silver-lead mine, Lake Timiskaming.

Mr. R. J. Ennis has returned to Porcupine from Toronto and New York.

Mr. H. A. Kee of the Nipissing staff is in Los Angeles.

Mr. G. C. Bateman is now field engineer, for La Rose mining company.

Lieut Harry H. Yuill has been awarded the Military Cross for conspicuous gallantry and devotion to duty.

Mr. J. Menard, formerly business manager of the West Canadian Collieries at Blairmore, Alberta, has been awarded the Distinguished Conduct Medal for gallantry.

Mr. John Church, chief engineer at the Dome mine has resigned. He will now make his headquarters at Haileybury. Before coming to Canada Mr. Church was chief engineer for the Goldfield Consolidated Co.

The first car of zinc concentrate was shipped on October 30th from Mr. J. P. Keane's custom mill at Rosebery, B.C. A brief account of Mr. Keane's enterprise will be found on another page.

The Sullivan mine of the Consolidated Mining and Smelting Company is now the largest producer of lead ore in Canada, and should in a few months be a large producer of zinc ore.

Mr. Kirby Thomas was in Toronto last week and has gone to Elk Lake to examine a silver property.

Mr. Burr Cartwright is in Toronto.

Mr. D. A. Thomas has returned to New York.

Mr. H. C. Hoover is in New York.

Mr. J. C. Murray is at Renfrew, Ont.

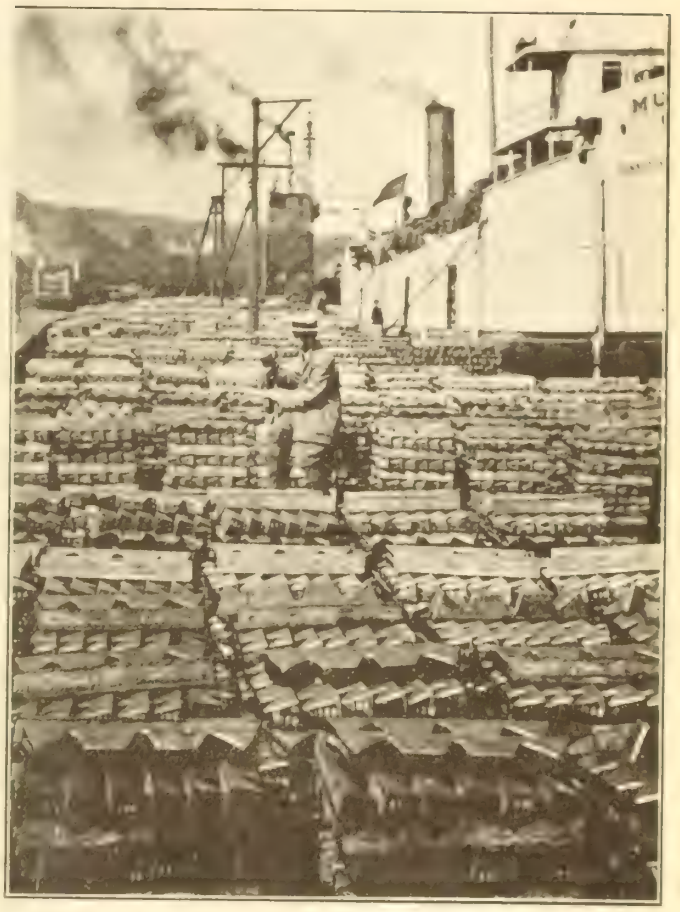
Mr. D. S. Halford, a graduate of Toronto University, demonstrated at the Arizona state fair a model of the oil flotation machine used at Humboldt smelter.

NIPISSING

During the month of October the Nipissing company mined ore of an estimated value of $177,183 and shipped bullion from Nipissing and Customs ores of an estimated net value of $211,950 according to the monthly statement just issued.

With the exception of one or two small veins nothing new was met with underground.

Preparations are being made to actively develop the Cobalt Lake fault-vein in Nipissing ground. The first work will consist in sinking a nearby shaft another 250 ft. in order to get down to the most favorable level. When this depth has been reached only a small amount of cross-cutting will be necessary to intercept the vein.



Loading a lake steamer with copper ingots at Houghton, Mich.

ELECTROLYTIC ZINC.

Anaconda Copper Co. produces the only electrolytic zinc in the United States. This ranks as high-grade spelter and commands prices comparable with those of the Horsehead brands of the New Jersey Zinc Co. at 10 cents a pound or better. The company has made good forward sales, although tonnage will not be large from the present equipment with a daily output of ten tons, or 20,000 pounds. The new brick furnace at experimental zinc plant at Washoe smelter will be completed and in operation before the end of the month. This will increase capacity of the plant from 10 to 25 tons of zinc per day, or monthly output of 1,500,000 pounds of zinc.

Eventually a zinc plant with a capacity of 5,000 tons of ore daily will be erected by the company.

COPPER FOR THE ENEMY

London, Nov. 2.—Germany and Austria are likely to obtain important supplies of copper from Serbia, according to Chedo Miyatovich, former Serbian Minister to London. The Bor copper mine is one of the best in Europe, and a junction recently was made between German and Bulgarian troops operating in the district where they are located. There also are anthracite coal mines in the Timok Valley.

Mr. Miyatovich in a statement to The Standard says the Serbian army can hold out in the mountains for a month longer, and that the invaders are likely to find little booty in a country exhausted by years of warfare, except what they take from the copper and coal fields.

SPECIAL CORRESPONDENCE

BRITISH COLUMBIA

Production of ore is being well maintained on the whole, as may be seen from figures that follow. Development work has been undertaken on a number of mining properties that had been long inactive, notably in the case of the Galena Farm, and several less important mines in Slocan district, while Nelson division is also having increased attention from men from the United States. Published statements that work has been commenced this year on a number of mines in Rossland camp that have lain unworked for years are little more than pleasant fictions, but it is true that in Ainsworth and Slocan divisions mines and mineral claims are now being worked that had not given employment to men over a number of years.

In striking contrast to the seeming indifference of Canadians and other Britishers to the mining possibilities of Kootenay district is the activity of a number of United States mining men, especially from Spokane, Washington. If a list were to be compiled of operating mines and the headquarters of those chiefly interested in them, it would be seen that the proportion controlled by Britishers is small. This comment has force in regard to the working of mining properties in Ainsworth, Slocan, and Nelson divisions, though not to Fort Steele division of East Kootenay nor to Trail Creek (Rossland) division of West Kootenay. In the Coast district, too, the larger metalliferous mines are in the hands of companies having headquarters in the United States. However, the most important thing is to have mining done, so if Britishers will not undertake it, men of other countries are gladly welcomed to do so.

EAST KOOTENAY

The quantity of ore shipped to Trail during four weeks ended October 21st, was larger by 289 tons, than during the corresponding period ended September 23rd the respective totals having been 3,875 tons and 3586, tons. For the expired sixteen weeks of the second half of the year 1915 the total is 15,261 tons, an average of 954 tons a week, as compared with 834 tons a week for the half year to July 1st. The total for 1915 to October 21st, inclusive, of 36,936 tons, compares favorably with that of 36,784 tons for the whole of 1914, and the expectation is that this year's total will exceed that of last year by 18,000 to 20,000 tons. This considerable improvement is due to the enlarged production of the Consolidated Mining and Smelting Co's Sullivan mine, which is now the largest producer of lead ore in Canada. It is probable that its output will shortly be further increased, for when the company is treating zinc ore at its Trail reduction works, the chief supply of such ore will be obtained from the Sullivan mine in which there is a large quantity awaiting the provision of suitable facilities for its utilization. The erection and equipment of zinc reduction works at Trail are being pushed forward with the object of commencing the production there of refined zinc by the end of the current year.

WEST KOOTENAY

Ainsworth.—There are now three mines in Ainsworth division that are shipping regularly to Trail, namely, the Bluebell, Cork-Province group, and No. 1. In addition, the Utica ships an occasional car of sorted ore, and several small lots of high-grade ore have also been sent to the same destination from properties from which a little ore has been taken in the course of prospecting. Since production was resumed at the Bluebell in September, 352 tons of lead concentrate has reached Trail from that mine, this being the total amount of the Bluebell product received during five weeks ended October 21st. During eight weeks to the same date the total received from the Cork-Province was 325 tons of silver-lead ore and concentrate, and the Consolidated Co's No. 1 mine shipped 953 tons of silver-lead ore during that period, while the Utica's total was 85 tons. The Florence mine is expected to shortly be on the shipping list, for it has a considerable quantity of ore opened ready for stoping and arrangements are being made for its transportation to the Highland mill for concentration there. Between 20 and 30 tons of ore has been packed down from the Martin mine, situated in the mountains above the Cork-Province group, and some of it has already reached Trail. The property was recently sold for $40,000 to East Kootenay men, who have paid $4000 on account of the purchase money.

Slocan.—Less silver-lead ore was received at Trail from Slocan mines during the four weeks ended October 21st than in either of two other similar periods ended September 23rd and August 26th respectively. The totals for four periods were as follows: For four weeks ended July 29th, 1,621 tons; ended August 26th, 2,292 tons; ended September 23rd, 1,931 tons; ended October 21st, 1,740 tons. The total for the 16 weeks was 7,584 tons, an average of 474 tons a week which compares with only 92 tons a week for the six months ended June 30th. The resumption of production from the Standard mine is largely accountable for the increased receipts at Trail from Slocan mines during the second half of the year. Silver-lead concentrate was shipped to the United States from the Surprise mine to the extent of 1,415 tons, mostly during the first half of the year. Adding this quantity to that sent to Trail, a total output is obtained of 11,384 tons of silver-lead ore and concentrate shipped to smelteries during 42 weeks of 1915 ended October 21st. Mines that shipped silver-lead ore or concentrate during the last eight weeks of this period were the following: In Slocan division—Standard 2,684 tons, Rambler-Cariboo 356 tons, Slocan Star 195 tons, Hewitt-Lorna Doone (Silverton Mines, Ltd.) 112 tons, Mountain Con 85 tons, Ruth-Hope 61 tons, Wonderful 39 tons, Wakefield 32 tons, and Rio 13 tons; in Slocan City division—Enterprise 43 tons, Ottawa 35 tons, and Alice S 16 tons. No figures are at present available to show the output of zinc ore and concentrate, but it is known that between 2,500 and 3,000 tons of zinc concentrate has been shipped this year by the owners of the Surprise mine, and that the Standard Silver-Lead Mining Co. has lately shipped much of the zinc concentrate produced during the last two or three months. Then there is the output of the Hewitt-Lorna Doone mine, and of several small producers of zinc ore.

Much interest has been taken locally in the recent shipment of two cars of high-grade silver ore from the Mountain Con mine, and of some antimony ore sent to England, from the Alps-Alturus property situated about 13 miles from Three Forks, at an altitude of about 8,000 ft. on mountains above the north fork of Carpenter creek. Of the 85 tons of Mountain Con ore, one car averaged about 1,065 oz. and the other 675 oz. of silver to the ton. The vein of antimony ore on the Alps-Alturus property is stated to be 2 ft. in width, and the ore to be of excellent quality. Some years ago ore was shipped to Trail from this property, but the price of antimony at that time was too low to leave a margin of profit above the cost of mining, transporting, and smelting the ore.

There are now six concentrating mills being operated in Slocan division, namely, those of the Rambler-Cariboo Mines, Ltd., on Seaton creek, above Three Forks; of the

Ruth Mines, Ltd., and the Slocan Star Mines, Ltd., both near Sandon; of the Standard Silver-Lead Mining Co., and the Silverton Mines, Ltd., near Silverton, Slocan lake; and the mill near Rosebery, higher up Slocan lake, recently placed in order by Mr. J. P. Keane and now concentrating zinc-lead ore from the Lucky Jim mine near Bear lake, on the divide between Slocan and Ainsworth mining divisions. The new mill at the Galena Farm mine, two miles south of Silverton, will be running before these notes are published. In all these mills two products are made—silver-lead and silver-zinc concentrates. The mill at Rosebery is a custom plant, and Mr. Keane's enterprise in so quickly arranging for operating this mill, only a few weeks after the destruction by fire of the Ivanhoe mill at Sandon he was previously operating on similar lines is proving of much benefit, since it has prevented the closing of the Lucky Jim mine which would otherwise be without concentrating facilities for its ore.

Nelson.—There seems to be promise of more mining activity in this division in the near future than in the earlier part of the year. In the neighborhood of the town of Nelson the outlook is better, for the Granite-Poorman gold mine and stamp mill are being worked at a profit, the Eureka copper mine is being further developed, and it is planned to shortly construct an aerial tramway from the mine down to the C. P. R. Co's railway, across Kootenay river, and a Spokane syndicate is doing development work on the Fern and adjacent property situated a few miles south of Nelson. In Ymir camp, the Yankee Girl lower workings are opening a vein that is expected to yield much ore and towers for an aerial tramway from the mine down to the railway at Ymir station are being erected, while the shipment to a smeltery of ore on the dump at the upper workings is being arranged for. At Deer creek, ten miles from Salmo, the output of oxidized zinc ore from the H. B. mine is being increased, more teams having been put on for hauling the ore to the railway. At the Queen gold mine, Sheep creek, the 700-ft. level is being driven to get under the big shoot of ore that has been mined on the 600-ft. level, along a distance of about 400 ft.; meanwhile the production of gold from other parts of the mine is being steadily maintained. In Erie camp, the Relief mine is continuing to make its customary output of gold. Taken altogether, there is an improvement in mining conditions in this division, as compared with the corresponding period of last year.

Rossland.— The weekly average production of the mines of this camp has not been so large during the sixteen expired weeks of the second half of the year as was that of the first half of the year. The total quantity of ore received at Trail from Rossland mines for six months ended June 30 last was 172,836 tons, an average of 6,648 tons a week; for sixteen weeks ended October 21 the total was 102,851 tons, an average of 6,428 tons a week. However, a comparison with last year's production figures is favorable, for while the total for the whole of 1914 was 289,320 tons, an average of 5,564 tons a week, that for the expired part of 1915—42 weeks—has been 275,707 tons, an average of 6,564 tons a week. If the rate of increase be maintained for the remaining ten weeks of this year, as it is quite probable it will be, the total increase in 1915 over 1914 will be about 52,000 tons. By far the greater part of this year's increase has been made by the Le Roi mine, as will be seen by the following figures showing the production for 42 weeks of each year, those in brackets being for 1914: Centre Star group, 150,601 (142,907) tons; Le Roi, 110,858 (69,518) tons; Josie, 14,243 (15,929) tons; sundries, 5 (38) tons; total, 275,707 (228,092) tons.

NOVA SCOTIA

Dominion Coal Outputs.—The production of the Glace Bay collieries of the Dominion Coal Company in September and October compared with 1914 as follows:

	1914 tons	1915 tons	Increase tons
September.....	341,953	419,265	77,312
October.....	368,016	408,200	40,184

The aggregate outputs for the ten months ending October 31st totalled 3,782,008 tons compared with 3,707,993 tons in the corresponding period of 1914, showing an increase of 74,015 tons for the year to date.

The production in November and December 1914, was very small, and it may be anticipated that large increases will be shown in the two remaining months of this year, when compared with 1914. The ouptut for the year 1915 will probably exceed 1914 by well over 200,000 tons. This is a matter for congratulation when it is remembered that up to the middle of September of this year the production was below that of 1914.

The Springhill Collieries, for various causes, have not done so well. The outputs for the ten months ending October, 1915, were 326,500 tons, compared with 343,492 in 1914, showing a decrease of about 17,000 tons.

Although the putput figures at Glace Bay show a large increase over the production of the corresponding months of last year, they do not nearly represent the capacity of the mines, which has been greatly reduced by enlistments.

Approximately, the enlistments from among the workmen of the Dominion Coal Company at the Glace Bay mines have totalled 1,500 men, the great bulk of which number are men who previously worked underground. The reduction in output has been from 3,500 to 4,000 tons per day, and what this means is apparent when it is known that the production of 408,000 from the mines in October could have been raised to 480,000 if the ordinary working force had been available.

SUDBURY

The sulphur smoke question looks nearer to a satisfactory settlement than ever before. The government has made a move that will be most satisfactory to both sides by withdrawing certain lands from settlement and allowing the mining companies to use these as roast yards. This will protect the farmers' crops as the selected sites have been chosen in places where the fumes will do little or no harm and it will benefit the residents in general. The mining companies will also derive great benefit as they will not be constantly being sued for damages by the farmers. It is thought that the roast yards of the Canadian Copper Company will be located near the Vermilion River while those of the Mond Company will be near Coniston, their present smelter town. This in all probability will mean increased business for the Algoma Eastern Railway.

Creighton mine had a banner month during October. In development 1,460 ft. was driven while the new shaft was sunk 164 ft., making it the record month. In other months the shaft has gone 146 and 136 ft., which was considered very good for the district. In all for both mining and development 102,000 tons was hoisted and of this 75,000 tons went to the roast yards at Copper Cliff.

Sudbury-Copper Cliff Railway.—The principal item of interest in the Sudbury district this week is the opening of the new street railway connecting Copper Cliff with Sudbury. The route takes in some of the principal streets of Sudbury and then follows the Sudbury Copper Cliff road to within a short distance of Copper Cliff, when it runs close to the C. P. R. tracks. In many respects

Cobalt and Sudbury resemble each other and although Sudbury is the older town it was Cobalt which was first to establish a street railway between Haileybury and Cobalt, later running on further north. It was not until this week that the Sudbury district had a trolley line connecting its two chief towns Sudbury and Copper Cliff. Later the line will be extended to Creighton.

Sudbury is this week giving a hearty welcome to the Australian Cadets who after taking in the sights of the Fair at San Francisco made a lecture tour in the States. The cadets number 35 and have several lecturers in their number who addressed members of the upper classes in the Sudbury schools. One day was given over to visits to the various mines and smelters.

Miners' Wages Increased.—The men of both the Canadian Copper Company and the Mond Nickel Company are anxiously awaiting to hear what the raise in wages will be. Some few weeks ago both of these companies announced that all men on hourly rate working 8 hours would have their wages increased, while those working longer hours would have their time reduced to 8 hours. The new schedule was introduced on Nov. 1st, but so far the amount of the increase has not been made public. This recalls conditions a few years ago. It is not very long ago when the men were working ten hours underground and the companies of their own will, some time before the 8-hour law was introduced, gave the men eight hours and increased the wage. The present increase makes the second in the year and the company is doing all they can to hold the men and keep a permanent staff. A fine recreation club is in course of construction at Copper Cliff. All this has been accomplished without any union and is a striking example of the good created by the absence of such. In addition the Canadian Copper Company gives its employees an opportunity to buy stock on the instalment plan.

Those who took advantage of the opportunity have already nearly doubled their money and have received large dividends in addition.

PORCUPINE, KIRKLAND LAKE & MUNRO

Gold Discovery in Pacaud.—The announcement of the discovery on the veteran claim belonging to Fred Connell and J. Macdonough brings forward another section of the gold field of Northern Ontario which may yield a mine or several mines with further prospecting. The township of Pacaud and Katherine have for years been considered good prospecting ground by mining scouts but there has been little work done here in as much as not more than one third of the northern half of the Township is open for prospecting. Approximately one third is taken up with mining claims and one third has been homesteaded by settlers who were allowed to homestead these rocky claims for the sake of the wood on them. Two months or more ago J. Macdonough happened to find the vein on a veteran claim belonging to a wealthy British Baronet. Negotiations were opened for the purchase of this veteran claim of 160 acres and its neighbor to the north. The bargain was finally consummated at a very reasonable price and now the value of the discovery is being made known. The vein which is quite well defined has been traced and partly stripped for 15 chains on one property. It runs across the line into another claim which is also owned by Messrs. Connell and Macdonough. The pay streak in the vein varies from two to sixteen inches in width in a quartz gangue of about four feet. There are very rich shoots in a dozen or more places in this pay streak, where free gold can be seen in spectacular quantities and another mineral which is probably a telluride is also discernible. There is also a little molybdenite in the ore. The 160 acres on which the rich discovery was made has been sold to George Miller of Detroit, who has been manager of the Miracle Mine near South Porcupine. Mr. Miller has bought outright the controlling interest in the property for a reasonable sum and he states it as his intention to proceed with the work forthwith. At the present time he has posted a man with a shot gun near the richest portions of the vein in order that it may not be high graded by wholesale as recent discoveries have been. This discovery is really in the Boston Creek field; it is about five miles south of the Boston Creek settlement but all prospectors go in from that point. It, and the active prospects for further work on the Kenzie claim in Boston Creek make this point a very active one for miners and prospectors.

Croesus Gold Mines, Ltd.—The property in Munro township which under the management of the Dominion Reduction caused so much excitement has been incorporated as the Croesus Gold Mines, Limited. The syndicate controlling this and the adjoining claims which they have taken up, consists of Messrs. Mortimer Davis in Montreal, and Mr. D. M. Steindler and his associates in New York.

Jupiter-McIntyre.—After a good twelve months of consideration the controlling interests in Jupiter have decided to accept the offer of the McIntyre Porcupine Mines. This, as already fully stated in an earlier issue includes a cash payment of approximately $60,000 to wipe out bonds and other indebtedness. The other payments will be made monthly to provide working capital for the Jupiter. The ratio of exchange of the Jupiter stock for the McIntyre-Jupiter stock will be at the ratio of two shares of Jupiter for one of McIntyre-Jupiter. Although the sale of control of the Jupiter to the McIntyre group was ratified by the shareholders meeting on October 29th there were still some loose ends of the business to be tied before work could actually be resumed on the Jupiter. It is quite probable that work will be actively undertaken on the Jupiter much before this appears in print. The agreement with the Jupiter provides for the treatment charge at the McIntyre mill which while moderate will leave a good profit for McIntyre shareholders, particularly when the aerial tramway is in operation.

Plenaurum Mines, Limited, have pumped out the shaft so that the mine may be sampled by the La Rose and other parties who have made bids for the property. Although the further development of the Plenaurum may be delayed it is most likely that the property will be working this winter. This will assure the Porcupine camp that all the mines and prospects on Pearl lake will be active this winter. The Plenaurum shaft has been full of water since the fall of 1912 when the labor strike took place.

Tough-Oakes mine has been running again on electric power for about a month. There is now ample power for both mill and mine at this Kirkland Lake property from Charlton. While it is not anticipated that any further trouble arising out of shortage of water will occur during the spring, nevertheless two big compressors have been ordered and are now being installed at the property. This and the power available will enable the Company to have at their disposal no less than 36 drills.

Lake Shore Mines at Kirkland Lake has resumed operations since the beginning of the month. Two drills are now at work, the shaft being sunk from the 200 to the 300 ft. level. Before the plant was shut down this summer some high grade ore was discovered in the west drift, both at the 100 and 200 ft. levels and developed for some distance. It is now proposed to establish another level on these ore shoots as quickly as possible.

Power from High Falls. Negotiations are on foot whereby it is probable that another power will be developed for the use of Boston Creek and Kirkland Lake camps. This power is at High Falls on the North branch of the

White River and it will give 2,000 H.P. at all seasons of the year. This concession was taken up by Messrs. Grover and Hotchkin and more capital is being found to develop it, by a company that has recently entered the Kirkland Lake field.

Tough-Oakes Dividend.—The first dividend declared by any gold mining company in Northern Ontario outside of the Porcupine camp was declared by the Tough-Oakes Gold Mines, Limited, last month. This dividend is for twelve and a half cents a share and will be paid on Nov. 15th, on 521,500 shares issued. It will amount in all to $65,187.50. The Tough-Oakes has produced in gross, over $800,000. This year alone it has produced $400,000. There is every probability that it will go on a regular dividend basis.

Dome Lake.—Following the circular issued by the Dome Lake Milling and Mining Company allowing that their request that further stock should be taken up, improvements have taken place in the width and grade of the No. 1 vein. The vein in the winze below the 180 ft. level is eight ft. wide of between seven and eight dollar ore for the whole forty ft. on which sinking has been done to date. A raise is now being put through to the 300 ft. level to connect with this winze. The same vein worked in the A shaft has furnished all the ore going to the mill since October 16th. Here a drift has been pushed in both directions for about 75 ft. at the 75 ft. level. For this distance the ore will average about $7.00 for a width of four to five ft. An inclined raise is to be put through from the end of the drift on the 100 ft. level of the main shaft to connect with the drift on the A shaft; all ore will then be handled from the main shaft. The production for the past two months has been much as usual. All bullion is still being sent to the Ottawa mint.

Vipond.—It has been officially stated by the president that there is no immediate prospect of a dividend on the Vipond. Mr. Ward says that during the past eighteen months the company has passed through a period of financing, mill construction, mine operation and mine development which does not permit of immediate disbursement of profits.

The Excelsior Mining Company, a syndicate of working miners operating the Gold Reef have pulled out their prospector's plant and five stamp mill from the Gold Reef and taken it down to the Tommy Burns claims in Shaw Township. The Excelsior Mining Company produced regular shipments of bullion from the rich but narrow veins on the Gold Reef. The property has now been taken over by the company itself. The Excelsior will adopt the same methods on the Shaw claims, where it is stated there are also some very rich high grade streaks.

COBALT, GOWGANDA AND ELK LAKE

Alien Enemies.—A revival of the question of the employment of alien enemies in the mining camps of the North has resulted from the action of the Mining Corporation of Canada. The head office of this company which is in England has sent orders to their operating company in Cobalt that all alien enemies on the pay roll of The Cobalt Lake, Cobalt Townsite and City of Cobalt should be fired and men of nationality friendly to the Allies, taken on in their places. This has already been done. The managers of local companies are now urging on the Government the necessity of the internment of these men. By reason of their nationality they cannot get work anywhere in the north and they consequently have grievances against the country of their adoption. The managers of companies naturally consider that it is likely to make them dangerous citizens, and they urge that they should be interned. For some time no company of standing in the district has hired any man of Austrian, Turk or German extraction, but they did retain the men they had. There were in the summer on the pay roll of the Mining Corporation of Canada 45 Austrians and 6 Germans. They have been thrown out of work and others of friendly nationality taken on in their places. In the Sudbury field registration is compulsory of all alien enemies to the British Empire and the Allies.

The Peterson Lake Company has dewatered and is now working from the old Nova Scotia shaft in order to reach the Nova Scotia lease under Peterson Lake. When the Nova Scotia Mining Company had this claim they produced a considerable quantity of high grade ore on a royalty basis and it seems possible that the Peterson Lake may have better success here than on other leases they have taken up and worked themselves.

Increase in Silver Shipments.—The arrival of 50 cent silver has seen the shipments of more bullion from the camp. This is particularly the case in regard to the Nipissing Company, which in the month of October shipped twice as much as in the previous month. In the month of November the company is maintaining their full output of bullion and it is probable that the last two months of the year will see a large production of silver from the Cobalt camp. While this may be so it is nevertheless quite true that the dropping off in production for the year will be much more marked than even last year. This is due entirely to the low price of silver and the expectation that it would shortly rise and that better profits could be obtained by holding it.

The following paragraph is from a Vancouver newspaper: Messrs. Richardson and Baird, the British commission appointed to secure coal miners to work in the Old Country left Vancouver on October 19th for Fernie, Crowsnest Pass, where they will endeavor to get more men. During their stay on Vancouver island they managed to get some 240 men, and they expect to considerably augment this number on their return trip to Montreal, as it is their intention to call at Calgary and other places in order to get in touch with miners who had gone to work in the prairie wheatfields, and who may be desirous of returning to England. The men who go to the Old Land will leave Canada in two steamers, one heading for Glasgow and the other for London, and they will take the places of miners who have gone to the front.

Three mines situated in the region around Hazelton, Omineca mining division, have shipped silver-lead ore to Trail during recent months. The Silver Standard shipped 92 tons and the Silver Cup and Sunrise 29 tons each. A very much larger quantity of copper ore has been shipped from the Rocher De Boule mine to the Granby Consolidated Co's smeltery at Anyox, Observatory inlet.

The Standard Silver-Lead Mining Co. has declared its usual monthly dividend to be paid in November, the total to be $30,000. With such ore developed and being mined and concentrated, the prospects are favorable for a maintenance of dividend payments indefinitely.

It is understood that labor difficulties have once more visited the plant of the Nichols Copper Co. at Laurel Hill, Long Island, which refines the Phelps-Dodge product, Calumet & Arizona, Superior & Arizona, Granby, Old Dominion and some smaller tonnages. The plant has a capacity of more than 1,000,000 pounds of copper daily.

The directors of the Tough-Oakes Gold Mines, Ltd., have declared an interim dividend of 12½c per share, payable November 15th.

MARKETS

NEW YORK STOCKS

November 10th, 1915.	High	Low	Close
Alaska Gold	30¾	29¼	30
Alaska-Juneau	12⅜	12	12¼
Allis-Chalmers	31	27	31
Anaconda	85⅞	82¾	85¾
Dome	25	24	25
Inspiration	43	41⅕	42⅘
International Nickel	188	180	188
Miami	33⅛	32½	33⅛
Ray	25¾	25	25¾

STANDARD MINING EXCHANGE

Toronto, November 11th, 1915

Cobalt

	Asked	Bid
Bailey	5	4¾
Beaver	31	30¼
Buffalo	65	49
Chambers-Ferland	13½	13
Coniagas	375	350
Crown Reserve	59	57
Foster	..	3
Gifford	..	2
Gould	⅞	⅝
Great Northern	3¼	2½
Hargreaves	2	1¾
Hudson Bay	2300	2000
Kerr Lake	390	375
La Rose	56	52
McKin. Dar. S.	31	30
Nipissing	680	650
Ophir	2	1
Peterson Lake	24	23½
Right of Way	..	4
Seneca Sup.	65	60
Silver Leaf	3¼	1⅞
Timiskaming	41¾	41¼
Trethewey	16	
Wettlaufer	9	7
York, Ont.	2	

Porcupine.

	Asked	Bid
Apex	3½	3
Dome Exten.	27	26½
Dome Lake	22	20
Dome Mines	2600	2425
Foley O'Brien	65	55
Gold Reef	3½	2¾
Homestake	..	25
Hollinger	2800	2600
Jupiter	11	10½
McIntyre	56	55½
McIntyre Extension	25	24
Moneta	8	7¼
Porcupine Crown	83	80
Porcupine Imperial	5	4⅞
Porcupine Vipond	75½	74
Preston E. D.	4⅝	4½
Teck-Hughes	10½	10
West Dome	8	7¾

TORONTO MARKETS

Nov. 10th, 1915—(Quotations from Canada Metal Co., Toronto)—
- Spelter, 18 cents per lb.
- Lead, 6½ cents per lb.
- Tin, 40 cents per lb.
- Antimony, 45 cents per lb.
- Copper Casting, 19¾ cents per lb.
- Electrolytic, 19¾ cents per lb.
- Ignot Brass, yellow, 13 cents; red, 15 cents per lb.

Nov. 10, 1915—(Qoutations from Elias Rogers Co., Toronto)—
- Coal, anthracite, $7.75 per ton.
- Coal, bituminous, $5.25 per ton.

NEW YORK MARKETS

Nov. 8th, 1915—Connellsville coke (f.o.b. ovens)—
- Furnace Coke, prompt, $2.50, $2.75 per ton.
- Foundry Coke, prompt, $3.00, $3.25 per ton.

Nov. 8th, 1915—Tin straits, 36.12½ cents.
- Copper, Prime Lake, 18.00 to 18.25 cents.
- Electrolytic Copper, 18.00 to 18.25 cents.
- Copper Wire, 23.25 cents.
- Lead, 5.00 cents.
- Spelter, 15.42½ to 15.67½ cents.
- Sheet Zinc (f.o.b. smelter), 16.50 cents.
- Aluminum, 56.00 to 58.00 cents.
- Nickel, 45.00 to 50.00 cents.
- Platinum, soft, $50.00 to $55.00 per ounce.
- Platinum, hard, $55.00 to $60.00 per ounce.
- Quicksilver, $100.00 per 75-lb. flask.

SILVER PRICES.

	New York. cents.	London. pence.
October—		
26	48⅞	23⅞
27	48⅞	24
28	49⅛	24⅛
29	49⅛	24⅛
30	49⅛	24⅛
November—		
1	49⅛	24⅛
2		24⅛
3	49⅛	24⅛
4	50	24⅛
5	50	24⅛
6	49⅞	24⅛
8	50⅛	24⅛

WHY NOT A COBALT COIN?

It may be permissible to point out that a still further avenue is open for the employment of cobalt. The 5-cent piece is the least desirable of our Canadian silver coins, mainly because of its smallness in size and the consequent difficulty in handling it, and especially of distinguishing it from the 10-cent piece without ocular examination. Why should it not be replaced by a coin made of pure cobalt, intermediate in size between the 10-cent piece and the 25-cent piece? Such a coin would have many advantages. It would be readily distinguishable from all other coins. It would be attractive in color, pure cobalt being similar in appearance to pure nickel, but somewhat more silvery, and tarnishing slowly, if at all. Being very hard, it would be difficult to counterfeit. Lastly the chief source of cobalt being for the present in Canada, a cobalt coin would be distinctively Canadian, and its introduction would strike a chord to which the national consciousness would readily respond. The coin could be called a "cobalt," just as the U. S. 5-cent piece of copper-nickel alloy is called a "nickel." By comparison, however, a pure cobalt coin would be greatly superior in appearnace and every other respect to the so-called "nickel," which contains only 25% of that metal.—T. W. Gibson, in Annual Report of Bureau of Mines, Ontario.

LAND $300,000 CONTRACT

Mr. Warren R. Roberts, president, and Mr Edward E. Barrett, vice-president, of the Roberts & Schaefer Co., engineers and contractors, Chicago, have just returned to Chicago after securing in Canada a contract with a large coal company for the designing and construction of an electrically operated anthracite coal dock bridge, and storage plant.

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PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

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YUKON AND NORTH-WEST TERRITORIES
Memoir 50. Upper White River District, Yukon, by D. D. Cairnes.

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Map 142A. Upper White River District, Yukon Territory. Topography.

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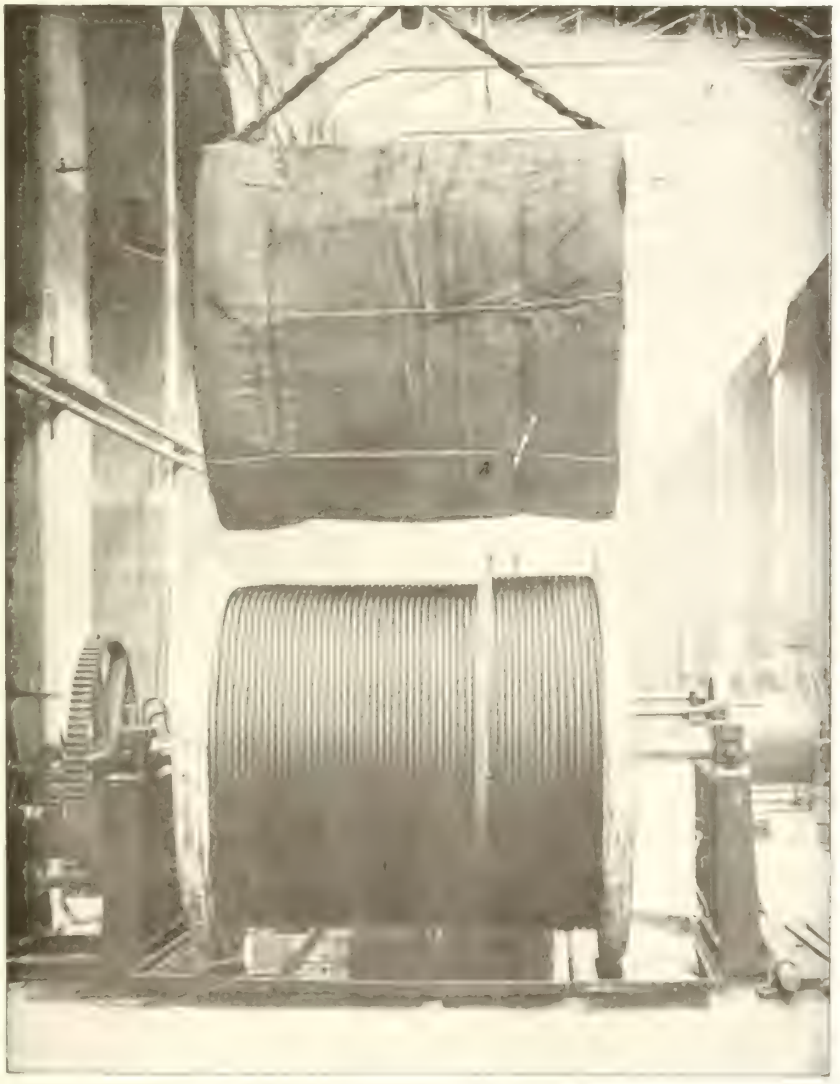

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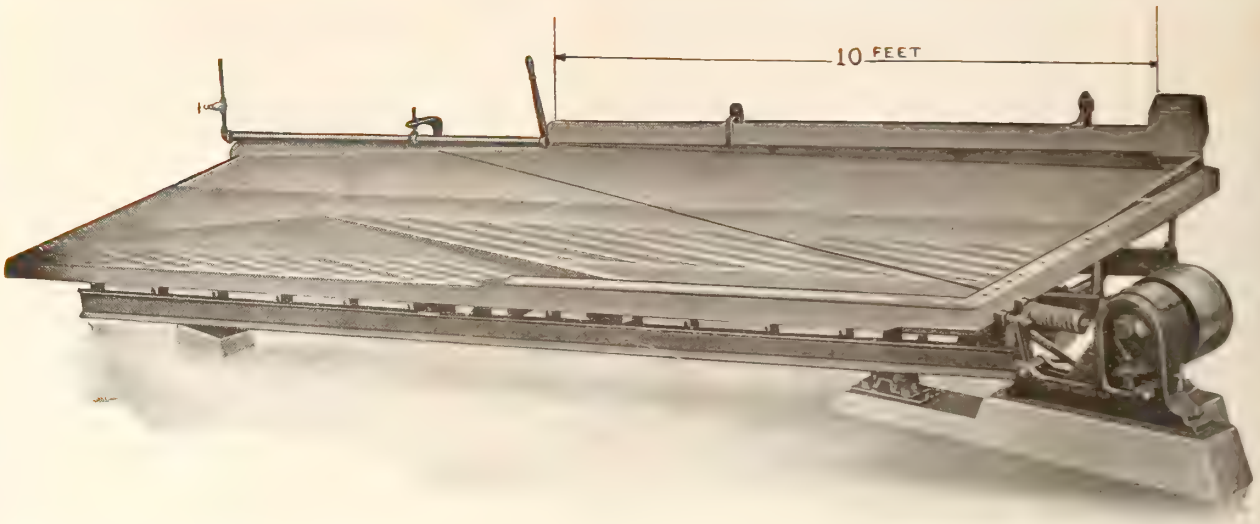

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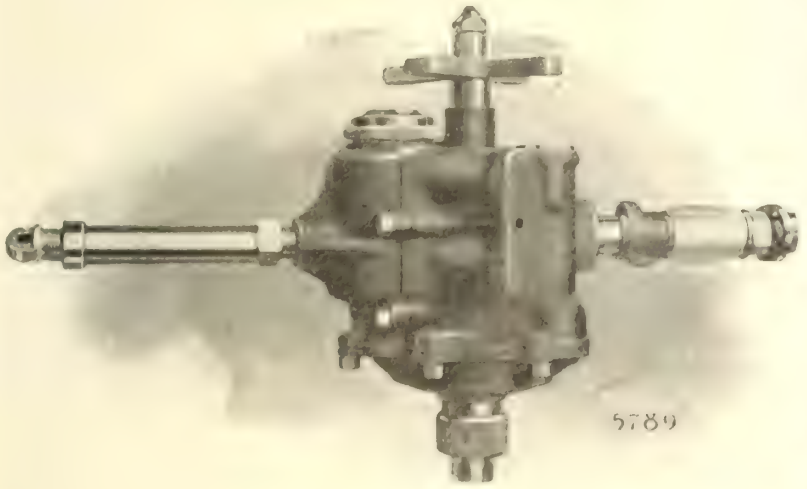

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Department of Colonization, Mines and Fisheries

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MINERS' CERTIFICATES. First of all, obtain a miner's certificate, from the Department in Quebec or from the nearest agent. The price of this certificate is $10.00, and it is valid until the first of January following. This certificate gives the right to prospect on public lands and on private lands, on which the mineral rights belong to the Crown.

The holder of the certificate may stake mining claims to the extent of 200 acres.

WORKING CONDITIONS. During the first six months following the staking of the claim, work on it must be performed to the extent of at least twenty-five days of eight hours.

SIX MONTHS AFTER STAKING. At the expiration of six months from the date of the staking, the prospector, to retain his rights, must take out a mining license.

MINING LICENSE. The mining license may cover 40 to 500 acres in unsurveyed territory. The price of this license is Fifty Cents an acre per year, and a fee of $10.00 on issue. It is valid for one year and is renewable on the same terms, on producing an affidavit that during the year work has been performed to the extent of at least twenty-five days labour on each forty acres.

MINING CONCESSION. Notwithstanding the above, a mining concession may be acquired at any time at the rate of $5 an acre for SUPERIOR METALS, and $3 an acre for INFERIOR MINERALS.

The attention of prospectors is specially called to the territory in the North-Western part of the Province of Quebec, north of the height of land, where important mineralized belts are known to exist.

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The Bureau of Mines at Quebec will give all the information desired in connection with the mines and mineral resources of the Province, on application addressed to

THE HONOURABLE THE MINISTER OF COLONIZATION, MINES AND FISHERIES, QUEBEC

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Synopsis of Coal Mining Regulations

COAL mining rights of the Dominion, in Manitoba, Saskatchewan and Alberta, the Yukon Territory, the North-West Territories and in a portion of the Province of British Columbia, may be leased for a term of twenty-one years at an annual rental of $1 an acre. Not more than 2,560 acres will be leased to one applicant.

Application for a lease must be made by the applicant in person to the Agent or Sub-Agent of the district in which the rights applied for are situated.

In surveyed territory the land must be described by sections, or legal sub-divisions of sections, and in unsurveyed territory the tract applied for shall be staked out by the applicant himself.

Each application must be accompanied by a fee of $5 which will be refunded if the rights applied for are not available, but not otherwise. A royalty shall be paid on the merchantable output of the mine at the rate of five cents per ton.

The person operating the mine shall furnish the Agent with sworn returns accounting for the full quantity of merchantable coal mined and pay the royalty thereon. If the coal mining rights are not being operated, such returns should be furnished at least once a year.

The lease will include the coal mining rights only, but the lessee may be permitted to purchase whatever available surface rights may be considered necessary for the working of the mine at the rate of $10.00 an acre.

For full information application should be made to the Secretary of the Department of the Interior, Ottawa, or to any Agent or Sub-Agent of Dominion Lands

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A miner's license costs $5.00 per annum, and entitles the holder to stake out three claims a year in every mining division.

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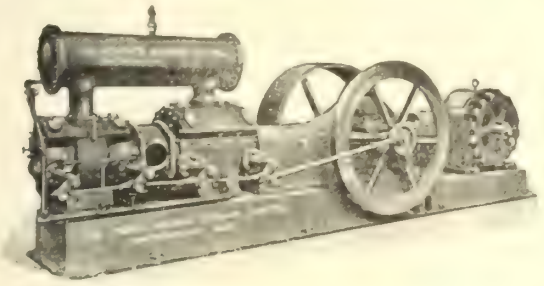

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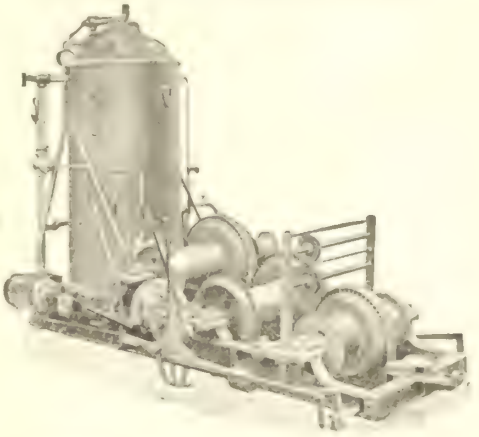

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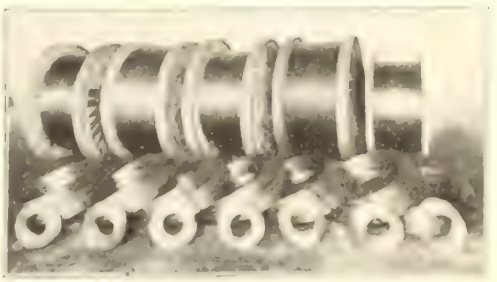

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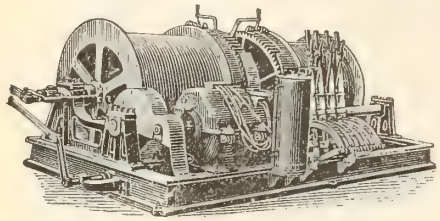

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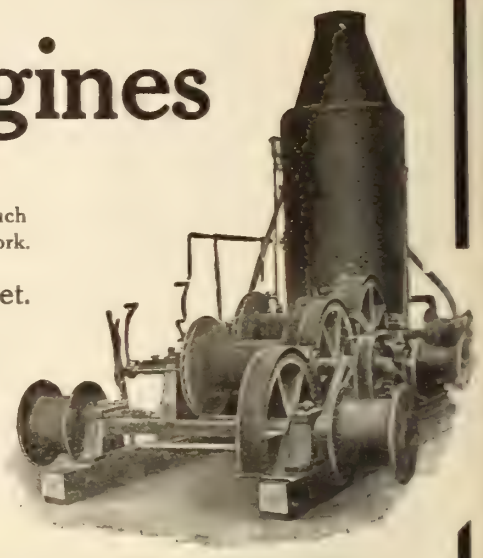

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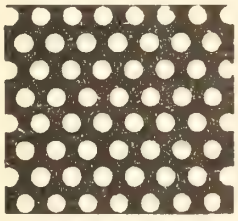

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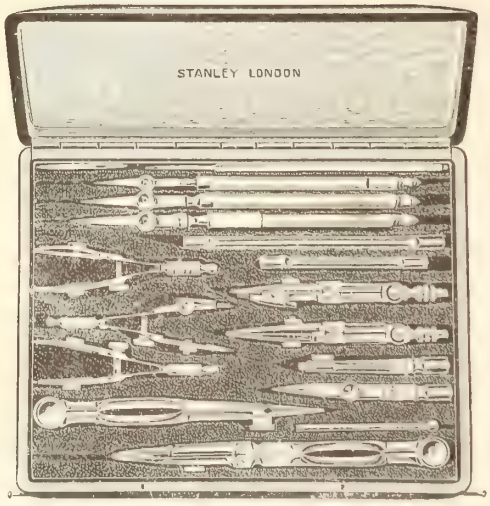

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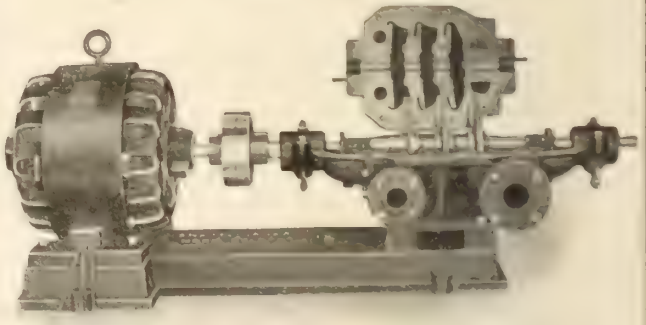

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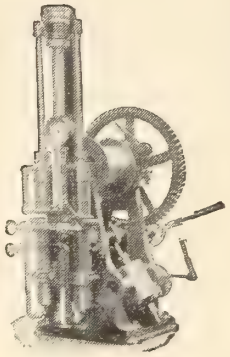

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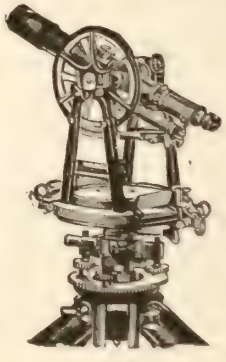

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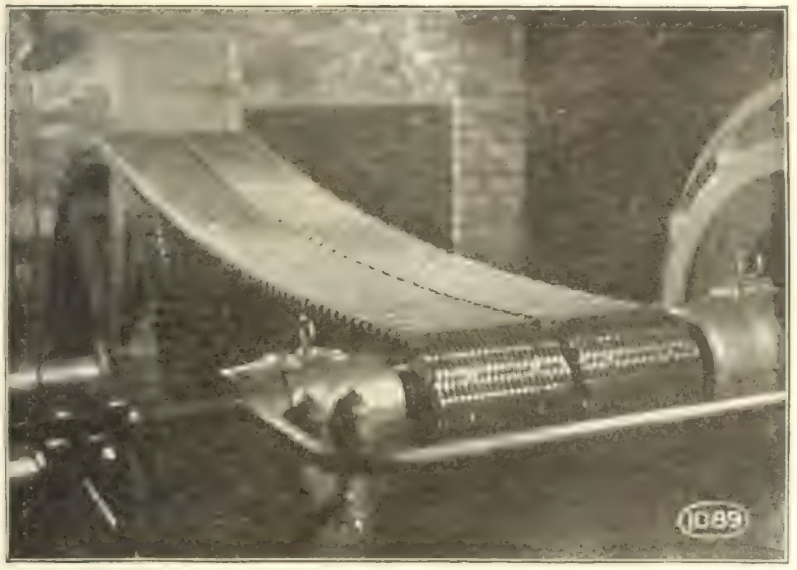

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Cobalt, Ont., May 18, 1914.
Messrs. Jones & Glassco,
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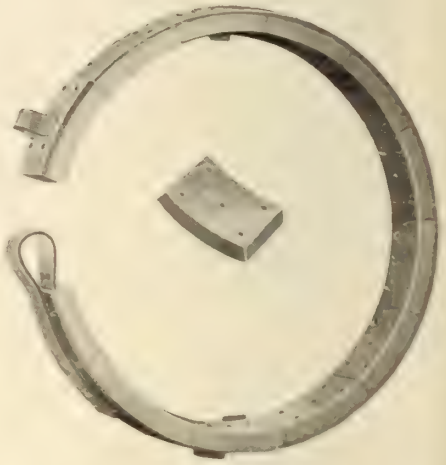

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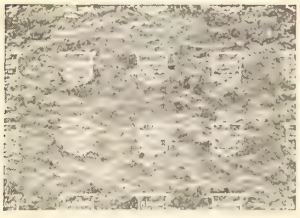

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THE CANADIAN MINING JOURNAL

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SILVER IN DEMAND AGAIN

A year ago most metals were cheap. The outbreak of war disorganized the market and the outlook was dark. Soon, however, the demand for metals became greater. Then the enormous orders for munitions brought about a revolution in the metal markets. Old customers put off their purchases, but new ones appeared. Then new and old customers both came into the market. Naturally the recognition of the increased use for metals resulted in higher prices. Most metals have been selling at good prices for months. Copper is in demand at 20 cents per pound. Lead is quoted at 5.25 cents, spelter at nearly 19 cents. Nickel is greatly in demand, and quotations are nominal at 45 to 50 cents per pound.

Some of the rarer metals are selling at very high prices. A sale of tungsten at $60 per unit was reported last week—an equivalent of $3,660 a ton for concentrates running 61 per cent. Quicksilver is quoted in New York at $105 per flask.

Iron and steel prices have been until recently quite low, the demand being poor and the future needs not anticipated. During the past few weeks the buying orders have been piling up and the result has been an advance in prices for which there is no comparison in the past decade of the industry.

Owners of silver mines have seen these rises in metal prices during the past year and have hoped that a similar recovery would show itself in the silver market. For months they have been greeted with quotations that have made them wonder whether their policy of waiting for improvement would be rewarded. Now in the past week the price of silver has risen with startling rapidity. It has taken silver longer than the other metals to find new markets. Apparently new and old purchasers are now bidding for silver.

With silver selling at 56 cents, the Cobalt silver district will likely experience such renewed activity as has made itself felt during the past few months in other metal mining districts. In Ontario the Porcupine gold and Sudbury nickel-copper mines are enjoying unprecedented prosperity and producing more metal than ever before. The Cobalt silver mines have been, during the period of low prices, marking time. Now the production will be increased, more development done, and prospecting will be resumed.

That plans for new work will now be made at Cobalt is highly probable. Doubtless there will be some hesitation until the higher prices become established, Cobalt silver mining companies can take much encouragement in an improved market and if the demand becomes permanent, Ontario silver districts will experience a busy winter.

MINING SCHOOL PROBLEMS

President William B. Phillips, of the Colorado School of Mines, in the November issue of the magazine published by that institution, calls attention to some Western mining school problems. Among other things, he says: "If we cannot link the actual practice in mine, mill and smelter, with the instruction in mining schools, something is wrong with the schools. I do not mean by this that any mining school should even pretend to graduate miners, millmen or furnace men. This is not the proper work of any such school." President Phillips considers that the great function is to train young men to think. "The training in such highly specialized matters as mining, ore dressing and metallurgy, is largely of a more or less prophetic nature. It is based upon the ability to forecast the future and to provide against its demands." Many will agree with President Phillips in his appeal for a thorough grounding in fundamentals. "There must be a thorough grounding and training in English, mathematics, chemistry, physics, mineralogy, the elements of geology, especially structural geology, metallurgy, commercial geography, social economy and history, and one or more foreign languages. I do not mention these things in the order of importance, but I do venture to say that English and mathematics are, by no means, the least important. And by English I do not mean the study of Milton, or Shakespeare, Ruskin or Emerson, but the acquirement of a good working knowledge of ordinary correct verbiage and phraseology, of correct spelling and correct grammar. By mathematics I do not mean calculus or the geometry of the Fourth Dimension, but I do mean arithmetic, algebra, plane and spherical trigonometry, and plane and solid geometry. Reliable statistics are lacking, but I believe that a large proportion of the scholastic troubles in mining schools are due to lack of thorough training in mathematics and English."

"A mining engineer should be of better and more thorough training than any other kind of an engineer, for he is called upon to know and to do more different sorts of things than any one of his ilk. He is, or rather should be, versed in civil, electrical, mechanical, hydraulic, mining and metallurgical engineering, have a working knowledge of one or more foreign languages, be able to speak and write the English language correctly, and to handle men."

In other words the mining engineer's training should include two or three years of general college work, followed by three or four years of more specialized study. The problem is how to condense it all into three or four years.

THE OIL FLOTATION PROCESS

Owing to the successful adoption of the oil flotation process by several large mining companies, flotation methods are attracting the attention of mining men everywhere. Our readers will therefore be interested in the paper by Mr. J. M. Callow, which is to be presented at the New York meeting of the American Institute of Mining Engineers, and which is published in this issue.

It has been found that minerals can be separated by treatment in machines with oil and acid. Certain minerals rise with the froth when the mixture is agitated, while others do not rise. By experimenting with various oils it has been found possible to make a very complete separation of the minerals in many ores. During the past few years metallurgists have made innumerable tests on hundreds of ores. The results in some cases have been excellent.

Concerning the discovery of the oil flotation process there are many stories. One story which has been given wide publicity is that the credit belongs largely to an observing Colorado woman, Carrie Jane Everson, who noted the selective action of suds while washing her brother's shirt. The Colorado Scientific Society has recently appointed a committee composed of George E. Collins, Philip Argall, and H. C. Parmalee, to investigate her claim to the honor.

It is said that over 165 patents have been granted to inventors covering various phases of the process. In the United States there are now scores of flotation plants in operation.

One of the greatest successes in the use of flotation process is the plant of the Britannia Copper Company at Britannia Beach, Howe Sound, British Columbia. In Ontario the process has been tried by the Mond Nickel Company for the treatment of nickel-copper ores, and is now being investigated by several of the companies operating at Cobalt. It is not unlikely that the accumulated tailings from the present concentration and cyanidation plants at Cobalt will eventually be treated by the flotation process.

According to a market letter issued by an enterprising New York firm of brokers, one of the largest silver interests in that city says in regard to the silver situation: "Mexico has produced practically no silver for months, and the Cobalt region has been unable to ship much silver, as its refining processes were dependent upon Germany, and that country naturally lent n[illegible] to the Canadian region." Our New York friends will be disillusioned if the price of silver keeps climbing as it has during the past week.

By courtesy of the Ontario Bureau of Mines, we publish in this issue a report by Mr. Jas. Bartlett on the gold discovery made on the Rogeon property south of Dryden, Ont. The Dryden district has been given a bad name by several failures there; but there is no good reason to conclude that none of the deposits can be profitably worked. Mr. Rogeon's discovery seems to be a very important one.

GOLD DISCOVERY NEAR DRYDEN

By James Bartlett.

In the latter part of October, 1915, the writer spent a part of one day on the Rognon gold claims south of Dryden. Gold was discovered this fall on surveyed claims A. S. 14 and A. S. 15, the property of Ernest G. Rognon of Dryden, Ont. These claims are situated on the west side of Contact Bay, Wabigoon Lake, and are in unsurveyed territory about 60 chains south of lot 2, concession 1, Van Horne township. In summer the claims are reached by taking a launch from Dryden along the west side of Wabigoon lake to Contact Bay; in winter the wagon road leading from Dryden to the Redeemer mine will be used.

The vein in which the gold occurs has a strike of about N. 70 degrees W. and appears to dip to the north at 75 or 80 degrees. Stripping has been done along the strike of the vein at intervals for some 1,600 feet, and, although the vein is not continuous for this distance, the rock has been fissured and quartz deposited to some extent along considerable of it. The vein is narrow, varying from a mere crack to 24 inches. At one point near the east end it may be considered eight feet wide if some schist be included. The vein-filling consists almost entirely of quartz, much of which is pink to red in color, due to the presence of hematite. Earthy red hematite occurs at different points in the vein. No sulphides whatever are visible. Free gold was seen in the wall rock in a small prospect shaft, 14 feet deep, sunk on the vein. At this point the vein averages 18 inches in width. In sinking the shaft Mr. Rognon has obtained a number of remarkably rich and beautiful specimens of gold-bearing quartz.

In order to obtain some idea of the distribution of values at different parts of the vein, ten samples of quartz were taken for assay. As moils were not available, the samples were taken by chipping across the vein with a prospecting pick. They, therefore, should not be considered "grab" samples. The chainages stated below are approximations. The samples were assayed for gold by Mr. W. K. McNaill, Provincial Assayer, and the following values obtained:

No. 1—Gold, $7.20 per ton. Sample taken 60 feet from east end of vein. Vein at this point 8 feet wide with some rock included.

No. 2—Gold, $7.60 per ton. Sample taken 170 feet from east end of vein. Vein 12 inches wide.

No. 3—Gold, $13.20 per ton. Sample taken 265 feet from east end of vein. This is from prospect shaft at depth of about ten feet. Includes twenty inches of quartz and three inches of soft schist from wall.

No. 4—Gold, none. Sample taken 275 feet from east end of vein. Width, 16 inches; quartz and a little schist.

No. 5—Gold, $2.80. Sample taken 300 feet from east end of vein. Width, 22 inches of quartz.

No. 6—Gold, $0.80. Sample taken 565 feet from east end. Width, 13 inches quartz + 2 inches schist from walls.

No. 7—Gold, none. Sample taken 635 feet from east end. Width, 15 inches quartz + inch red hematite.

No. 8—Gold, none. Sample taken 720 feet from east end. Width, 14 inches quartz.

No. 9—Gold, $85.40. Sample taken about 1,000 feet from east end of vein. Width, 15 inches rusty quartz.

No. 10—Gold, $1.00 per ton. Sample taken about 1,500 feet from east end of vein. Width 18 inches white quartz.

The country rock is a fine-grained gray to pale green rock in which biotite was the only mineral which could be identified in the hand specimens. The schistosity is not marked a short distance from the vein. Thin sections were made from samples taken on both sides of the vein and were examined under the microscope by Mr. A. G. Burrows of the Provincial Geologist's staff. Mr. Burrows reports as follows regarding these samples:

No. 1 country rock, south side of Rognon vein.—A fine-grained rock. Under the microscope it is seen to be of igneous origin. The prominent constituent is plagioclase feldspar in rods, while a few broad crystals of plagioclase are also recognizable. In addition there are numerous rods of hornblende and flakes of biotite. Sample is a schist which has been derived from a diorite; name, diorite schist.

No. 2 country rock, north side of Rognon vein.—A dark, fine-grained rock showing under the microscope fine grains of a colorless mineral and numerous crystals of biotite.

The latter mineral is partly altered to chlorite. There seems to be a few obscure plagioclase crystals. The sample may be called a very fine-grained biotite or mica schist. The origin, whether from igneous or sedimentary rock, is uncertain, but is probably igneous."

About ten chains north of the vein a rock occurs which appears to be a volcanic breccia with tuff associated. About ten chains south of the vein is a large body of granite.

Further work is certainly warranted on these claims and it is to be hoped that this discovery may lead to a revival of interest in the district as a whole. Were this a new territory, the gold-bearing quartz recently found on these claims would undoubtedly cause a rush of prospectors into the district. Several companies operated to a small extent in the country west of Wabigoon lake several years ago, but, so far as can be learned, little trenching was done and a great deal of likely rock remains unprospected and open for staking.

RENEWED ACTIVITY AT COBALT.

Cobalt, Nov. 26.—The rise in the price of silver has set the managers of the various producing mines planning to increase production. The Timiskaming, which for a long time has had only 29 stamps of the mill running, will probably start the remaining 20 and begin running at full capacity. Coniagas, which has curtailed its operations almost to the limit, merely mining enough to pay running expenses and provide for further development; the Nipissing, Beaver, and others will, if the increased price is maintained, increase their production to full capacity. Sixty-cent silver would have a wonderful effect on the camp in this way, and would, according to a number of the mine managers, result in some producing mines being looked

GIFFORD

Cobalt, Nov. 23.—It is understood [illegible] Gifford Cobalt Mines are [illegible] property, which adjoins the Beaver. The main shaft is down 250 feet. The property has [illegible] of 160

THE UTILIZATION OF MINERAL PRODUCTS

At a meeting of the Royal Canadian Institute held in Toronto Saturday evening, November 20th, Mr. Geo. T. Holloway, chairman of the Ontario Nickel Commission, delivered an address on "The Relation Between the Chemical and Metallurgical Industries." He pointed out how chemists and metallurgists working together have overcome many difficulties. The Scotch shale industry, paralyzed by the discovery of large quantities of petroleum, recovered by the utilization of paraffin wax and ammonium sulphate and is still flourishing through the assistance of chemists. The continued existence of the Cornish tin industry is largely due to obstinacy and skill in obtaining everything possible from the ore, fighting against decreased values. Basic slags, formerly a waste product, have become a large source of revenue through use in fertilizer and cement manufacture. By-products of coal have become very valuable through development of processes of saving them cheaply and making a market. Cobalt is at present produced in large quantity with the silver of the Cobalt district, but new uses must be found for it. Chemists who have investigated the properties of cobalt and its alloys have helped to find such a market.

"The future of all mining, metallurgical and chemical processes depends on the ability to treat low grade materials. Rich ores are becoming rare and the country should make use of all, just as the Chicago packer utilizes all his products. The metallurgist and chemist can work together with the miner to reduce costs."

Mr. Holloway referred to the different conditions in old and new countries. England, except for coal, is largely dependent on imports. Canada having ample supplies of most materials seeks to find and open up new markets. In doing this we should seek to keep control of raw material and complete treatment as far as possible.

The industrial success of Germany is attributed to co-ordination of chemical, metallurgical and other industries. Mr. Holloway gave some account of the development of the aniline dye, alkali and zinc-lead industry.

The sulphuric acid industry is of very great importance to metallurgists, for metallurgy depends largely on the direct use of sulphuric acid or on the sale of it. The acid is used for so many purposes that prominent men have said they could measure the industries of countries by the amount of sulphuric acid used. It is especially interesting to note that much of the acid recovery has resulted from legislation prohibiting the discharge of SO_2 into the atmosphere. The sulphuric acid and alkali industries of England are dependent largely on the recovery of by-products saved under compulsion.

VANCOUVER CHAMBER OF MINES ANNUAL MEETING.

The annual meeting of the Vancouver Chamber of Mines was held in the Board of Trade rooms November 10th. Despite adverse conditions, the Chamber reported itself as clear of debt and at present on a sound basis.

The report of the executive committee was submitted by Mr. John Cunliffe. In the course of his report Mr. Cunliffe said:

"The ore exhibit and library have been open to members and visitors on all business days throughout the year, and nearly 3,000 persons took advantage of its privileges. These included miners, prospectors, owners of mineral claims, mine owners, and several investors, or agents of such, on the lookout for opportunities for investment. The data at the disposal of the Chamber were supplied in every case, together with the names and addresses of the owners of mining properties likely to meet their needs. The result of this information we are unable to say.

"Enquiries by correspondence for the year exceeded one thousand letters, etc., and covered a considerable part of the civilized world. Amongst others were letters from South Africa, Australia, New Zealand, Italy, the British Isles, Mexico, from most of the large cities of the East, Middle West of the United States and Canada, from the principal points of the Yukon, and the cities of the Pacific seaboard from Alaska to Mexico."

The following officers were elected: President, Prof. J. M. Turnbull, University of British Columbia; first vice-president, Mr. Robert R. Hedley; second vice-president, Mr. Nichol Thompson; hon. treasurer, Mr. James Ashworth; hon. secretary, Mr. John Cunliffe; and executive committee, Messrs. L. W. Shatford, M.L.A., R. S. Lennie, K.C., C. E. Cartwright, R. C. Campbell-Johnson, W. A. Blair, E. A. Haggen, A. McPhail, A. E. Hepburn, W. E. Bland, A. B. Buckworth, George H. Turner, Dr. Brock, G. S. Eldridge and James G. Powell.

BAR SILVER.

New York—There is an exceedingly strong undertone to bar silver in London and a sharp advance in the next few weeks would cause no surprise. Up to a few days ago, estimates were that £1,500,000 to £1,600,000 silver was in floating supply in London. Last week it was found that actual floating supply was less than £880,000.

India, usually a heavy purchaser of silver, has made no purchases thus far this season. Conditions in India now, except in one of the many provinces, are much more favorable, and it is expected India may come into the market again soon. China has unusually large stocks of silver owing to slack condition of business, but none is likely to find its way to London.

Trading in London is entirely on a cash basis and thus far small in character. The Bank of England has purchased a great deal of silver for coinage, and the continent has also purchased for similar purposes. These purchases have been small daily, but constant and sooner or later will have marked effect.

In addition, there has been some curtailment of silver production, especially in Mexico, which represents about 30% of American production. This is having effect on shipments to London from New York, and American Smelting & Refining Co.'s stock of silver, melted but unsold, is understood to be sub-normal.

SENECA-SUPERIOR DIVIDEND.

The Seneca-Superior dividend declared payable December 15 will bring the mine's dividend payments to a total of 195 per cent. or $929,848.

STEEL COMPANY OF CANADA.

Hamilton—The Steel Company of Canada is doubling its capacity at Hamilton. Earnings of the corporation are establishing new high records, but it is not likely that any statements will be issued until March of next year.

A NEW INDUSTRY FOR NEWFOUNDLAND

By J. W. McGrath.

During the session of the Newfoundland legislature held last spring a bill was passed conferring large and important concessions upon a corporation known as the "Newfoundland Products Co." The company has been incorporated under the laws of this colony, and its personnel consists of the following persons: Thomas L. Wilson, of Woodstock, Ontario, and the members of the Reid Newfoundland Co. Mr. Wilson is well and favorably known in the manufacturing and industrial life of Canada, but his reputation rests chiefly on his discovery of carbide. The Reid Newfoundland Co. is so well and favorably known not only in Canada and Newfoundland, but also in the United States and the United Kingdom, that anything I may say would be superfluous; suffice to add, the Reid Newfoundland Co. is a class of people any country may feel proud of. Being the builders, owners and operators of the Newfoundland railway system and the large fleet of steamships plying on the different bays and around the coast line of Newfoundland, and largely connected with the commercial, industrial and social life of the country, they have been very important factors in the great material progressive advance Newfoundland has made during the past twenty-five years. In the hands of such men then, there is no reason to doubt that the Newfoundland Produce Co. will grow and expand to rival all other industries except the fisheries.

The chief and primary object of the company is to manufacture ammonia phosphate which is a fertilizer, and in addition ammonia, cement, woodpulp and lumber. The company proposes to establish a plant at Bay of Islands—on the west coast of the island—at a cost of $18,000,000, and the Newfoundland Government has leased to them for a period of 99 years the water powers in and upon Humber river and Junction brook together with an immense deposit of marble or limestone along the Humber river. To produce ammonium phosphate, five ingredients are necessary, namely,—phosphate rock, sand, coal, marble and pyrites—and it is assured that with the exception of phosphate rock, which at the beginning of operations will be imported from Florida, all the other elements can be produced in Newfoundland, and there is very just reason to think that deposits of phosphate rocks will also be found within the island. From the phosphate rock the sand and coke [illegible] acid is produced, and from the lime and coke a carbide is obtained, and this carbide with the nitrogen and pyrites produces ammonia, and the combination of the two, that is phosphoric acid and ammonia, produces the ammonium phosphate which is the fertilizer. From the pyrites, sulphur dioxide is produced, and the union of this with pulpwood produces woodpulp. The slag remaining from the finished product, ammonium phosphate will be [illegible]

In addition to the vast concessions in water powers, limestone and surface land granted by the Government, the Reid Newfoundland Co. have passed to the company vast areas of timber and pulp lands at Grand Lake, adjoining the location. The timber from these concessions will be utilized in the manufacture of [illegible] pulp and sawn timber. The manufacture of phosphate of ammonia as a fertilizer in the manner as stated above is an entirely new process, and is covered by patents taken out by Mr. Wilson and secured to the company. The application of these patents renders the manufacture of the fertilizer the most economical of any process known to the world. For over a year or more a corps of engineers have been making the necessary survey of the Humber river with its tributaries, valleys and drainage. The work of survey has been directed by the well known firm of Messrs. Joseph Wallace & Co., of New York and London, ably assisted by the Reid Newfoundland Co.'s staff of engineers.

The work to date has cost $1,000,000, and has been most satisfactory; and reports show that a development of 120,000 horse power can be obtained on the Humber river. It is thought that it will take not less than three years from the beginning before the plant is established and at a cost of $18,000,000 before a dollar's worth of product is shipped. What the establishing of such an industry will mean to this country is not an easy matter to grasp at present. To produce the industry contemplated, when the business is in full swing, will require 239,805 tons of phosphate rock annually, or 657 tons daily; 600 tons of coal daily, or 219,000 tons yearly; 411 tons limestone daily, or 150,015 tons yearly, and 29,200 tons of pyrites each year. This will produce 120,000 tons of phosphate of ammonia, the value of which is $80 per ton, or $9,600,000 per year.

The fertilizer used to-day is a mixed one of ammonia, phosphoric acid and potash, costing about $40 per ton, but the fertilizer which will be produced by the Newfoundland Products Co. at their plant at Bay of Islands will be six times more valuable and will be sold to the Newfoundland fisherman-farmer at a rate which will not be more than one-half of the price he is [illegible] for fertilizer. In addition to the above as a side line, the company will use 100,000 cords of spruce pulpwood yearly, from which will be produced 36,500 tons of sulphite pulp at a value of $1,825,000. To carry on such a large undertaking as this, an army of 3,000 men, of all grades, will be continually employed upon the plant at various rates of wages, no man getting less than $1.50 per day, even the most ordinary laborer. From the engineers' reports I gather the following facts as to the possible cost of establishing this plant:

Water power cost	$6,440,300
General work	2,564,000
Industrial plant	3,745,000
Phosphoric acid plant	900,000
Ammonia plant	450,000
Working capital	2,000,000
Railway revision	250,000
Total	$16,349,300

The amounts as itemized for the various structural works, with supervision and capital, are as follows:

Ten dams, at a total cost of	$1,597,500
[illegible]	[illegible]
Penstocks, head gates and racks	771,200
[illegible]	[illegible]
Wing dams	297,500
[illegible]	[illegible]
Water wheels	589,000
Electrical equipment	1,065,000
Miscellaneous	58,900
Transmission lines	612,800
[illegible]	[illegible]
Engineering and supervision	387,700
[illegible]	[illegible]

Construction and Equipment.	
Coke and gas works	$799,000
Lime quarry	75,000
Lime kilns for 250 tons production per day	142,000
Calcium carbide works	462,800
Carbide crushing works	71,400
Electrode carbon work	25,000
Saw mills	211,800
Sulphite pulp mills, electrolytic bleaching plants and wood preparations	1,568,300
Machine shops, iron and brass foundries, boiler and structural shops, forges, pattern shops and storage rooms	161,400
Engineering and supervision of foregoing items	228,300
Total	$3,745,500

Cost of General Work.	
Grading site and filling in foreshore	$263,600
Construction docks	270,600
Installation coal and other material, handling equipment and storage	692,000
Construction and equipment of storage warehouses, eight buildings	467,000
New location of railway and construction railway sidings	140,500
Railway equipment for use of the yard premises, locomotives, hopper bottom cars, flat cars and locomotive trains.	$113,000
Construction of bridges, tide gates, tidal basins and trackage	51,200
Railway station and general offices of the company and mill store houses	200,000
General transformer station	156,000
Water supply, sewerage, lighting and fire protection of industrial sites	65,000
Engineering and general supervision	145,100
Total	$2,564,000
Cost of phosphoric acid plant	$900,000
Ammonia plant	450,000
Working capital	2,000,000
Railway revision	250,000
Total	$3,600,000

In introducing the Newfoundland Products Co. Bill in the House of Assembly last April, the Premier of Newfoundland, Right Hon. Sir E. P. Morris, made the following statement: "It is impossible to conceive the developing influence of such an industry in the country. Not alone will it be a labor giving industry, but it will bring about the establishment of a city, and create a livelihood for thousands of families with consequent advantages to the whole country."

No more desirable location could be selected for a great industrial operation, being distant only a few hundred yards from the Humber river, whose novel scenery is amongst the finest in the world.

CHILE COPPER.

Consulting Engineer Pope Yeatman, of the Chile Copper Co., says. "Up to date the ore mined has been taken from the upper layers of the orebody, which was and is known to be of lower grade than the average of the mine. The work so far indicates that the expectations and estimates of the engineering staff of the company will be fully realized with the operation of the first unit on the average grade of the ore of the mine."

A RETROSPECT

By F. H. Mason.

The office calendar reminds me more forcefully each morning that the great exposition is swiftly drawing to a close. As I look back over the past nine months, it is with a feeling of satisfaction that something has been accomplished and the assurance that the mineral industry of Canada has obtained an advertisement that will forever remain in the memory of a large proportion of those who visited the Canadian pavilion. In looking back, too, it is gratifying to note the uniform approval of the Canadian mineral exhibit by those whose praise is of value. "What one would expect from Canada," said John Hays Hammond; "Excellent and highly instructive," said Thomas A. Edison; "Bully," exclaimed T. A. Rickard, with editorial terseness; "The finest mineral exhibit I ever expect to see," G. G. S. Lindsey wrote in the register, with pardonable pride of a participant. Thus it ran through the whole period of the exposition; I have not heard a discordant note.

But what is perhaps of greater importance, in a backward glance, is to note in which minerals visitors manifested the greatest interest. About which minerals the most inquiries have been made. In order to reply intelligently to this, one has to classify the visitors. Fully ninety per cent. of the people who passed through the Canadian pavilion neither knew nor cared anything about minerals; yet many of this larger proportion asked questions, and mostly inane questions, at that. These, of course, must be eliminated.

Of the intelligent questions, undoubtedly the largest number were about the hydro-magnesite, from Atlin, B.C. Magnesia is coming more and more into everyday use in a number of different ways, and the form of the mineral at Atlin—disintegrated material that can be handled by a steam shovel—appealed to the investigators.

The asbestos exhibit elicited an enormous number of questions—both sane and insane. There appears to be more misconceptions among intelligent people about this mineral than about any other. It is commonly supposed to be the most refractory substance known, and that anyone armed with a suit of asbestos could successfully defy Satan and all his hosts in the hereafter. Even when inquirers were assured that asbestos would not fulfil all these requirements, often they were not satisfied until they had a complete list of the producers and manufacturers of the material in Canada, and many begged hard for a specimen of this wonderful substance.

The ores of the rare metals, molybdenum and tungsten, came in for numerous inquiries; there was always a sharp demand for information about zinc and antimony ores, and, at one time, there were many inquiries for manganese ores.

The silver ores of Cobalt brought forth many demands for information, as did the ores of Porcupine and the gold and platinum nuggets from British Columbia and Yukon Territory were always a source of interest.

The nickel case, which, by the way, was the most effectively arranged case in the exhibit, produced numerous inquiries, and some of the rarer nickel and platinum-group minerals, like polydymite and sperrylite from the Vermilion mine, Sudbury, Ont., added to the exhibit through the kindness of Mr. A. D. Miles, were a source of much interest to mineralogists.

With the big increase in the output of the Granby Consolidated Co.'s smelters, demand for information about the company's ores and about British Columbia copper ores in general increased considerably, and there is little doubt but that the attention of many people has been directed in that direction through the exhibit.

The mica case elicited many inquiries from manufacturers of electrical machinery—it is strange how persistently the name isinglass is used for this substance—and there were many suggestions from chemical manufacturers that a process should be devised for the extraction of potash from the excellent specimens of potash-feldspar exhibited. The building and ornamental stones came in for a fair share of attention, as, in fact, did nearly all the minerals, at one time or another, but those mentioned have received more attention than their fellows.

The members of the mineral department of the Canadian commission made a point of keeping in close touch with the nature and extent of the deposits from which the exhibited minerals came, and also of the uses of the various minerals and the processes they underwent to render the valuable constituents of service, and they were thus able to impart much valuable information to interested visitors. Another pleasing feature of the mineral exhibit is the way it has been kept up to date; many new exhibits, representing recent discoveries, having been added since the original installation.

RED ROSE GROUP, OMINECA, B.C.

It has been stated in British Columbia newspapers that the Red Rose group of mineral claims, in Omineca mining division of that province, has been bonded by Messrs. Hogan and McAdam, of Edmonton, Alberta, representing a syndicate. The following information of this property has been taken from a report by Mr. J. D. Galloway, assistant mineralogist for the province:

The Red Rose basin is a small basin or amphitheatre in the Rocher Deboule mountains. Rocher Deboule camp is situated in Juniper basin, at the head of Juniper creek, and is distant ten miles from Skeena Crossing. Juniper and Balsam are two small creeks which join and flow into Kitsequekla river, which in turn empties into the Skeena near Skeena Crossing.

The Red Rose group of claims, consisting of the Red Rose, Yellowhammer, Prosperity, Juniper and Summit, is owned by Peterson & Ek. The claims are situated on the northern side of Red Rose basin, and extend upward from the head of Balsam creek to nearly the top of the mountain at an elevation of 8,000 ft. The main vein is on the Red Rose at an elevation of 5,625 ft., and is known as the "Lower Showing." This would seem to be a fissure vein from 4 to 5 ft. wide occurring entirely in a grano-diorite formation, and is developed by a number of open cuts, trenches, and an adit 30 ft. long. In the adit the vein shows a width of 4 to 5 ft. of considerably oxidized and leached out siliceous vein matter, and contains a considerable amount of pyrrhotite and some chalcopyrite. The sulphides occur mostly on the footwall in a fairly well-defined paystreak, which at the face of the adit is 30 in. wide. The remainder, or two feet, of the vein on the hangingwall does not contain any appreciable amount of sulphides and is mainly siliceous gangue, which is not a true quartz, but is an alteration and silicification of the granitic wallrock. The vein strikes N. 30 deg. W. and dips to the southwest at 45 to 50 degrees.

An average sample across the 30-in. paystreak returned the following assay value: Gold, 0.84 oz.; silver, 3.2 oz.; copper, 3.9 per cent.; while a sample across the two feet of vein matter on the hangingwall assayed: Gold, 0.02 oz.; silver, 1.4 oz.; copper, 2.1 per cent. At the time of visiting the property a severe snowstorm was in progress, so that it was hard to ascertain much about the surface exposures. Apparently, though, this showing is very close to the contact between the granodiorite and quartzites and argillites of the Hazelton group. The vein in the tunnel, above mentioned, is entirely in the granodiorite, but a number of other exposures of rusty material containing pyrrhotite and copper stain are evidences of the development of ore in and around the plunging contacts which the granodiorite makes with the older volcanic rocks.

Taking into consideration the assay results above noted, together with the very favorable conditions for the possible formation of a large orebody, there is no doubt that this property is well worthy of further development work.

The upper showing of this group lies up the mountain from the lower one at an elevation of 7,500 ft. The snowstorm alluded to prevented climbing to and examination of this working, but Mr. Ek supplied the following description: It is a large vein showing lenses or stringers of iron (probably pyrrhotite) across a width of 200 ft. In one place there is an 18-in. paystreak of copper ore. Very little development work had been done, but it was intended to drive a tunnel during the autumn at one of the best-looking places. A sample of the ore obtained from Mr. Ek, and said to represent an average of the 18-in. paystreak referred to above, assayed: Gold, 0.30 oz.; silver, 2.3 oz.; copper, 8 per cent. A sample, similarly typical of the iron occurring across the vein in many places assayed: Gold, trace; silver, 0.8 oz.; copper, 1.4 per cent.

ZINC FROM BRITISH COLUMBIA.

In October, the Standard Silver-Lead Mining Co. shipped much of the zinc concentrate that had accumulated at its mill near Silverton, Slocan lake, British Columbia, during the period that suitable arrangements for its sale were not in force. The Nelson Daily [illegible] published recently the following comment on [illegible] shipments of the production [illegible] October. A comparative statement of shipments of zinc ore and concentrate during the month of October in 1914 and 1915, respectively, shows that this year there was an increase of 1,395 tons over the quantity shipped last year. This was due to the shipment of 1,836 tons from the Standard Co.'s mill at Silverton to Bartlesville [illegible] as against [illegible] for the 1914 corresponding month:

From	1914 Tons	1915 Tons
Surprise mine		80
Rambler-Cariboo mine	171	160
Standard mine	465	1,836
Hewitt mine	279	140
Total	915	2,310

NOTES ON FLOTATION*

By J. M. Callow.

The selective action of oils for lustrous minerals was first disclosed by Haynes in 1860. In 1885, Miss Carrie Everson elaborated this idea and also disclosed the fact that acid increased the so-called selective action. Her patent called for oils, either animal, vegetable or mineral, also for an acid or salt. The process was tried out on a practical scale in Baker City and Leadville, in 1889, and failed: first, because, as has since been shown, of the unsuitability of the ore to flotation; and second, because the invention was too far in advance of the times. Then followed the Elmore brothers, first with their bulk oil processes and later with their vacuum method. The basic principles of oil flotation were undoubtedly covered by the above inventors, the work done since their time being merely a building up on ground work laid by them. Different kinds of oil, different quantities of oil, and all the varying degrees of agitation, were all exemplified and practised by them in one phase or another, and the developments that have since been made are but elaborations of the fundamental principles laid down by Haynes, Everson and the Elmore brothers.

In 1902, the Potter-Delprat process was developed in Australia. In this process no oil was used, the mineral being raised by the generation of gas, brought about by the introduction of acid into the pulp. The mineral particles appeared on the surface of the separatory vessel, in the form of a scum or froth, buoyed up by minute gas bubbles attached to them. This no doubt first gave the suggestion of gaseous flotation.

In 1902, also, Fromont, an Italian, was granted a patent in which he combined violent agitation with oil and gaseous flotation, the gas being generated within the pulp, in much the same way as in the Potter-Delprat process.

In the same year, Cattermole came out with a unique method. First, the pulp was emulsified with a small quantity of oil, by violent agitation, and then submitted to a slow stirring action in a second machine. This granulated, or coagulated, the minerals that had been oiled into nodules which were afterward separated from the pulp by gravity. The defect of this process was that only part of the mineral granulated, the rest of it appearing on the surface of the pulp as a scum or froth, and so was lost in the tailings. This defect of the Cattermole process suggested the fundamental idea of the process afterward described by Sulman, Picard and Ballot in their patents, in which, instead of granulating part of the mineral, all of it was floated. This patent forms the basis of all the Minerals Separation operations. It was first exploited in Australia and in a short time replaced all other flotation processes in that country.

In 1904, MacQuisten brought out his ingenious tube process, which gave excellent results on the sandy portions of the feed, but was inoperative when slime was present. This was a strictly surface-tension method, and its inability to handle slime was a serious limitation. In 1912, Hyde introduced a modification of the Minerals Separation process into the mill of the Butte & Superior Co., Butte, Mont. This differed from the regular practice in that roughing and cleaning of the concentrates was done.

Callow Pneumatic Flotation.

Early in 1909, I did a great deal of work with the MacQuisten flotation process, and was instrumental in the tube-plant installation at the Morning mill at Mullan, Idaho. This work was followed by a large amount of experimenting on the different kinds of existing flotation processes, the outcome of which was the development of the pneumatic process.

The first application of pneumatic flotation for the treatment of ore was made at the mill of the National Copper Co., at Mullan, Idaho, which was designed and built by me. Construction was started on August 14th, 1913, and the plant went into operation about April

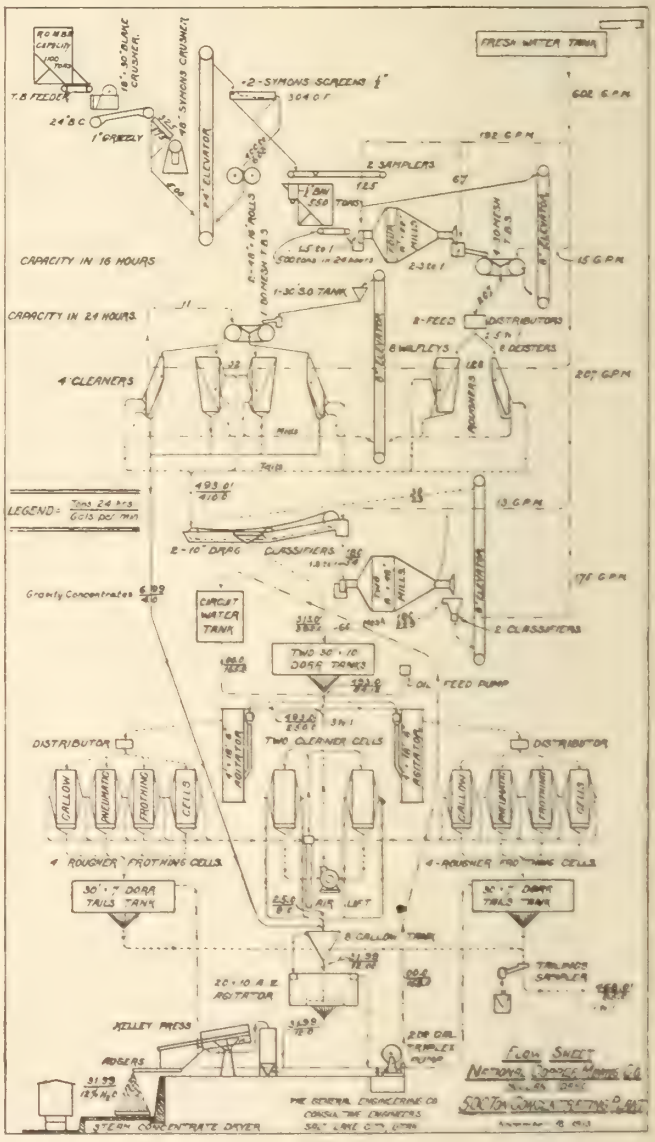


Fig. 1

10th, 1914. The flow sheet is shown in Fig. 1. It was a metallurgical success in every way from the start.

Since that date, the process has been adopted by nearly all the other mills in the Coeur d'Alene, treating lead and lead-zinc ore, notably the Gold Hunter, Morning, Hercules, Bunker Hill & Sullivan, Caledonia

*A paper presented at the annual meeting of the Utah Section, American Institute of Mining Engineers, Salt Lake City, Oct 4, 1915, and to be presented at the New York meeting, Feb., 1916.

Last Chance, Hecla, Standard, etc., a total of about 50 cells in all, treating from 1,500 to 2,000 tons of slime and fine sand feed per day. The same process too has since been adopted by the Inspiration Copper Co., the Arizona Copper Co., the Anaconda Copper Mining Co., the Magma and other copper companies, and by the Silver King, Daly-Judge, Duquesne, and El Rayo mining companies, on lead, zinc and other ores, making a total of some 680 cells operating, or in the course of installation, having a combined capacity of about 25,000 to 28,000 tons per day.

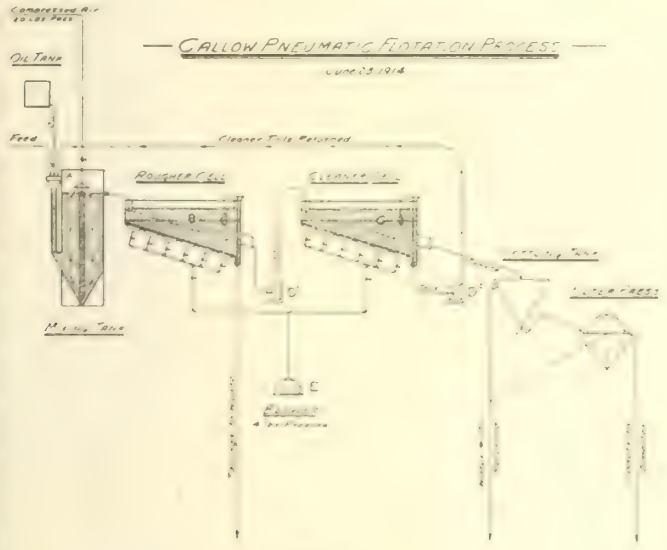


Fig. 2

Fig. 2 illustrates the various elements composing the Callow process in general.

Mixing.—In the mixer A, operated by compressed air, the oil, air and water are mixed and emulsified, the same type of apparatus being in common use in cyanide works. In cases where the oil, or frothing agent, can be fed into the crushing machine or tube mill, this mixer, or Pachuca tank, can be dispensed with, the tube mill discharging direct to the separatory cell.

It has been conclusively proved that agitation *per se* is not necessary to successful flotation by the pneumatic method. In one of the plants, a Pachuca mixer for each four roughing cells was installed. The pulp from a Dorr thickener was delivered to the Pachuca by a belt-and-bucket elevator, the oil being fed into the boot of the elevator. It was found that the mixing obtained in the elevator alone gave as good results as when the Pachucas were used; so the use of Pachuca tanks in this plant was abandoned.

The Separatory Cell.—The initial or roughing separatory cell B consists of a tank about 9 ft. long overall, and 24 in. wide, with a bottom inclined at from 3 to 4 in. to the foot; it is 20 in. deep at the shallow end and 45 in. deep at the other end. It may be built of either steel or wood, but wood construction is preferable.

Fig. 3 shows the cell in detail. The bottom of the tank consists of a porous medium made of four thicknesses of loosely woven canvas twill properly supported by a backing of perforated metal to prevent its bulging when under air pressure. Through this porous medium compressed air is forced by the blower E (Fig. 2). Porous brick, or any other ceramic material, that will give the necessary fine subdivision to the air, may also be used. Some of these have been tried out, but for practical and mechanical reasons the loosely woven canvas twill seems to serve all purposes better than anything else, and has been adopted as the standard porous-bottom construction.

The space underneath this porous medium or bottom is subdivided into eight compartments, each connected by an individual pipe and valve with the main air pipe. By this means the air pressure to each compartment can be regulated (by throttling the valve) to correspond to the varying hydraulic head within the tank, and so as to discharge a uniform amount of air throughout the length of the bottom and maintain a uniform aeration of the contents. A pressure of from 4 to 5 lbs. is generally used, each square foot of porous medium requiring from 8 to 10 cu. ft. of free air per minute.

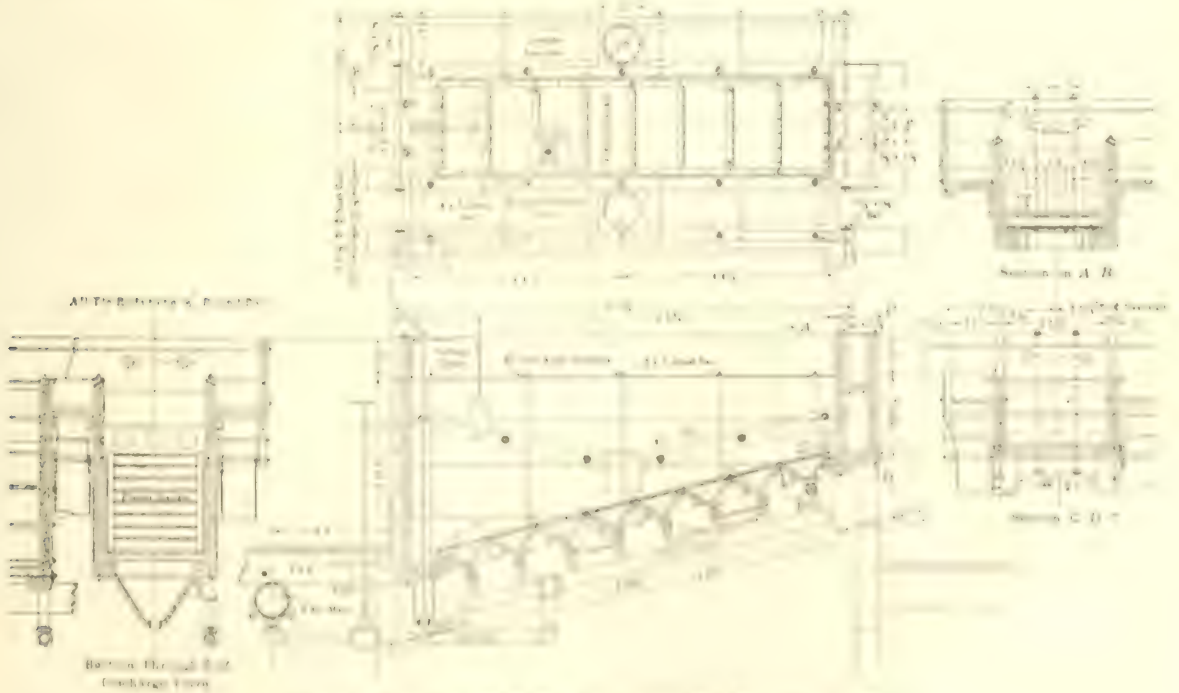


Fig. 3 Details of Callow pneumatic flotation cell

Each longitudinal edge of the tank is provided with a lip and an overflow gutter for the reception of the froth to be discharged. The lower end of the tank is furnished with a spigot discharge fitted with a plug valve, operated by a float, to maintain a uniform water level within the tank and thus, in turn, maintain a uniform and constant discharge of froth under all the varying conditions of feed supply incident to practical milling operations. The water level may, of course, be varied, but is usually maintained at about 10 to 12 inches below the level of the overflow lips.

The tailing is discharged through the spigot and the frothy concentrate is conveyed by means of the side gutters to the pump D^1 and thence to the cleaner separatory cell C. This cleaner cell is a machine of the same construction as the rougher. In operation, however, it is usually run with a lower air pressure than that used on the rougher. The tailing from the cleaner is returned by pump D^2 to the original feed, a closed circuit thus being maintained on this portion of the feed. The concentrate from the cleaner is the shipping or finished concentrate. Pump D^1 can well be eliminated by setting the cleaner at a lower elevation and conveying the rougher froth to it by gravity. Usually one cleaner serves four roughers.

Cells May be Used in Parallel or Series.—The machines may be run either in parallel or in series without any sacrifice in the capacity for a given number of cells.

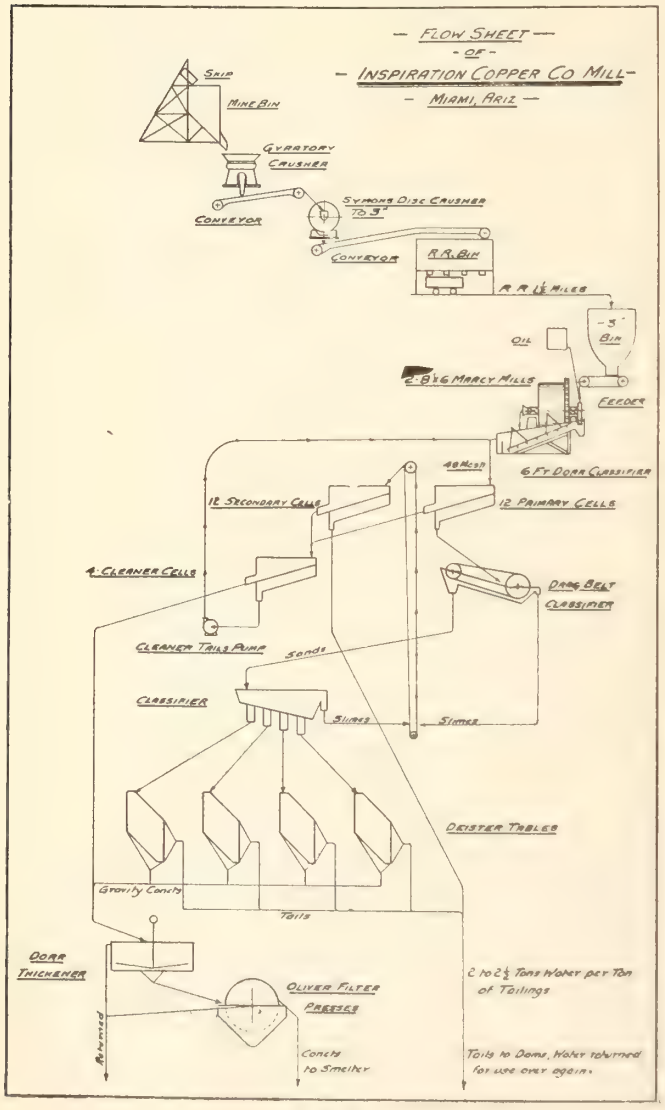


Fig. 4

Recent experience goes to show that on some ores the series treatment gives a slightly cleaner tailing; on others it does not. It is not necessary to extend this arrangement of cells beyond two cells in series. In a heavily mineralized ore this arrangement is decidedly advantageous, and in such a case the rougher concentrate might be of high enough grade to dispense with the re-cleaning operation. The froth from the second cell in the series might be returned to the original feed, in the same way that the tailing is returned from the cleaner when practising a roughing and cleaning operation. A number of such combinations are possible.

At the mill of the Inspiration Copper Co. (Fig. 4), the original feed goes to 12 primary roughers, the tailing from which is classified into sand and slime, the sand going to tables and the slime to 12 secondary roughers. The concentrates from both the primary and secondary roughers go to four cleaner cells, and the tailing from the cleaner cells is pumped back into the circuit.

Froth Formation.—The froth is generated as the result of injecting the finely divided air into the bottom of the already emulsified pulp; it continues to form and to overflow so long as it is furnished with pulp of the proper consistency, adequately mixed with the right quantity and kind of oil or frothing agent. Measured from the water level within the tank, the froth produced may be from 14 to 16 in. thick and will be more or less voluminous, coarse or fine grained, dry or watery, according to the character of the ore and the kind and quantity of oil introduced. The condition of the froth may be varied therefore by changes in the kind and quantity of oil used, and the quantity of air injected.

In some ores, rich in sulphides, and where a comparatively low-grade concentrate will suffice, the cleaning cells may not be necessary, but on low grade ores having a high ratio of concentration and when a concentrate of extreme cleanness and of maximum grade is required, a cleaner is desirable.

Pulp Density.—The pulp to be treated may be of varying density, from 2½ of water to 1 of ore, up to 5 or 6 to 1. For a mixture of sand and slime, the former ratio is preferable, but for a pure slime mixture (minus 200 mesh) the larger proportion of water is allowable. The particular density is not a matter of so much importance as the supplying of pulp of uniform density, since each variation in the density of the pulp requires a readjustment of the oil supply, the quantity of oil increasing in proportion to the increased volume of the pulp, independent of its solid contents.

Capacities.—A normal capacity for each standard roughing cell is 50 tons per 24 hours. This, of course, will vary according to the nature of the ore. In one plant, which practises gravitation previous to flotation, only the fine sand and slime being treated, the rate is 50 tons per rougher cell. The Inspiration Copper Co. practises flotation as the sole process, each 800 ton section employing 24 roughing cells and four cleaners. The cells in this case are run in series, the primary cells treating the original feed and the secondary cells treating only the slime from the primary, tailing after the sand has been removed. This gives an average of 33.3 tons per roughing cell. The Arizona Copper Co.'s plant (Fig. 5) will treat the slime and re-crushed sand from previous gravity treatment, out of an original tonnage of 4,000 about 3,600 tons will

be treated by flotation. This will be handled on 63 roughers run in parallel, and 18 cleaners, or an average of approximately 57 tons per roughing cell, or 45 tons per cell for roughing and cleaning.

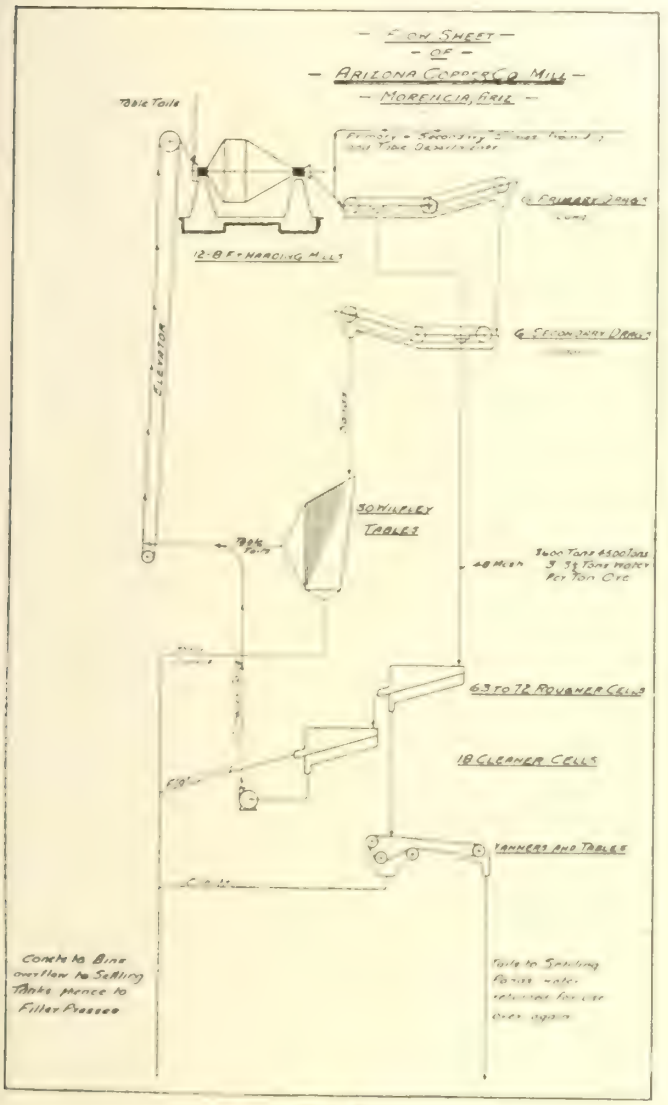

— F on Sheet —
— of —
— Arizona Copper Co. Mill —
— Morenci, Ariz. —
Table Tails
12-8 Ft. Hardinge Mills
Elevator
30 Wilfley Tables
40 Mesh
63 to 72 Rougher Cells
18 Cleaner Cells
Tailings to Settling
Conn. to Bins overflow to Settling Tanks pence to Filter Presses

Fig. 5

Some tests have shown little difference in recovery, whether running 45 tons to the cell or 65, but that the recoveries commence to decline as soon as the tonnage exceeds 75 tons. In the Coeur d'Alene ore-mixed ores, 35 tons per cell is an average capacity. The flow sheet of the Daly-Judge mill (Fig. 6) shows the arrangement for treating a zinc-lead ore in the form of a fine sand and slime feed.

Oils Used.—The oils used may be broadly divided into "frothers" and "collectors." The pine oils are good frothers and coal tar and its various subdivisions are good collectors. On some ores, crude pine tar will in itself combine the properties both of frothing and collecting; on others, this may have to be enriched by the addition of some one of its more volatile constituents, such as refined pineoil, turpentines or wood creosote.

Generally speaking, the coal-tar products are poor frothers, and to get a sufficient volume of froth to insure a high recovery, it is often necessary to add refined or crude pine oil. At the Inspiration mill, for instance, the mixture is 80 per cent. crude coal tar, 20 per cent. coal-tar creosote; at another plant on similar ore 45 per cent. El Paso coal tar, 40 per cent. coal-tar creosote, 10 per cent. creosol and 5 per cent. pine oil. At Daly-Judge a mixture of 40 per cent. crude coal tar, 40 per cent. creosote and 20 per cent. pine oil was used. In the Coeur d'Alene on zinc ore straight wood creosote was used; on the ore of the National Copper Mining Co., plain turpentine will work, but pine oil is better.

At Inspiration, from 1½ to 2 lb. of mixture per ton of ore was used; at Daly-Judge, 1 to 1½ lb.; and at the National 3/10 lb. of oil is sufficient. In the experimental work at another plant the oil consumption was approximately 1 lb. of mixture per ton; but since the entire plant has been in operation, and the circuit water reclaimed and used over again, the oil consumption has dropped to 0.35 lb. At present the proper kind or kinds of oil and the quantity requisite can only be determined by experiment; no scientific way has thus far been found.

Character of Froth.—The froth made by the pneumatic process has the distinctive characteristic of being unstable or ephemeral; that is, it quickly dies when

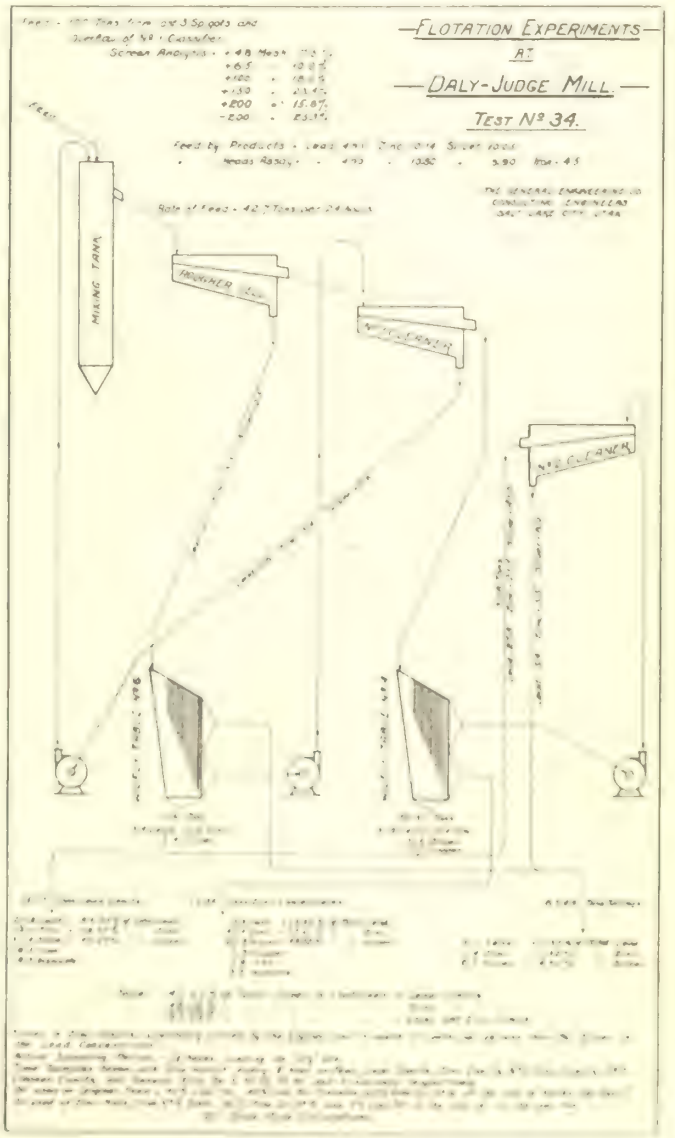


Fig. 6

removed from the action of the frothing reagent. The bubbles composing the froth are generated under a hydraulic pressure ranging from 15 to 40 lb. per sq. in., forcing the water to the froth zone through

burst by reason of the lower pressure of the atmosphere. On bursting, they release the mineral attached to them, which is caught up by the bubbles following immediately behind. The stability of the bubbles depends to some extent, upon the oil used and the nature of the gangue in the pulp treated. Pine oil makes a brittle froth which dies immediately on arriving at the surface. Creosote and light oil make a more elastic envelope which at times will expand into bubbles 3 to 4 in. in diameter before bursting. Pine oil bubbles are rarely over ¼ to ½ in. in diameter. Castor oil, olive oil, candlemakers' oil (oleic acid), palm oil, sperm oil, and other oils of a lubricating nature, have in general been replaced by oils more or less soluble or miscible in water—such as turpentine pine oil, and all the coal and wood-tar distillations. The extremely volatile oils, such as naphtha, gasoline, ether and alcohol, seem to be of little use except as means for making the pitchy ingredients of coal and wood tars more soluble or miscible.

A large, coarse and elastic bubble seems necessary to the recovery of coarse-grained mineral, but for the very fine and colloidal mineral, a small and comparatively brittle bubble is necessary.

Power.—The National Copper Mining Co., using approximately 950 cu. ft. of air at 4 lb. pressure, and treating 500 tons per day on eight roughers and two cleaners, required 35 h.p.; this shows a requirement of 3.5 h.p. per cell, equivalent to 12.53 tons per horsepower or 1.25 kw. hour per ton.

Another company using approximately 9,600 cu. ft. of air at 5 lb. pressure and treating 2,400 tons per day on 48 roughers and 12 cleaners, requires 210 h.p., equivalent to 3.5 h.p. per cell, 11.45 tons per horsepower, or 1.56 kw.-hour per ton.

The experimental plant of the Inspiration Copper Co., using approximately 950 cu. ft. of air at 5 lb. pressure and treating 200 tons per day with four roughers and one half-size cleaner, required 24 h.p.; deducting 4 h.p. for two 2-in. centrifugal pumps the figures become 4 h.p. per cell, 10 tons per horse-power, or 1.79 kw.-hour per ton.

A maximum figure would be 2½ kw.-hour per ton of feed, using 5 to 5½ lb. air pressure, generated by Roots or Connersville positive blowers.

Costs.—Oil—The oil mixtures generally in use cost from 1.25c. per lb. up to 3c. per lb., depending on the percentage of creosol and other high-priced oils used; on most ores, 1½c. per lb, is a safe average figure, and a consumption of 1 to 1½ lb. or from 1.25c. to 4.5c. per ton of feed, averaging 2½c. would be a safe estimate.

Labor.—This will vary, of course, with the size of the plant. At one plant consisting of 60 cells, two men per shift operate the entire plant, equivalent to a cost of 1¼c. per ton. One man per shift on a 250 ton plant means a cost of 5.4c. per ton maintenance. Assuming a life of three months per blanket, a capacity of 50 tons per cell, and an allowance for repairs to blowers, motors, pumps, etc., we have ½c. per ton as a liberal allowance.

Power.—With power at 1c. per kilowatt-hour, and a consumption of 2½ kw.-hr. per ton, the cost would figure 2.5c. per ton of feed.

Summarized the estimated cost on a 2,000 ton flotation plan, or larger, would be approximately as follows:

	Per Ton. Cents.
Labor	1.25
Oil	2.50
Maintenance	0.50
Power	2.50
Total	6.75

On a plant of 250 tons the extra labor costs per ton would bring it up to approximately 10c. per ton of flotation feed.

Actual figures from a large plant treating over 2,000 tons by flotation gave 6.1c. per ton; the flotation feed in this case represents 60 per cent. of the crude ore tonnage, making the cost 3.5c. per ton of crude ore treated.

Theories of Flotation.

So far no satisfactory explanation of flotation phenomena has been advanced. At my instigation and under my direction, a large amount of research work has been done in an endeavor to formulate some logical explanation of the phenomena, and perhaps to find some scientific way of conducting flotation experiments in place of the empirical methods now in vogue. Although the latter object has not yet been attained, still these experiments have resulted in the formulation of a theory that appears to be well grounded and that may prove of interest and value to others engaged in this art.

Much work has been done at the Mellon Institute at Pittsburgh under the direction of Dr. Raymond C. Bacon, and lately by James A. Block at the station of the U. S. Bureau of Mines in Salt Lake City. The result of all this work is summed up in the following statement:

In considering the connection between flotation phenomena and the physical properties of the minerals concerned, there are two parallelisms:

First.—It has been noticed for some time that the minerals which floated were not easily wetted by water, while those which were easily wetted did not tend to come up with the froth. This is the basis of about the only theory so far widely circulated; it was well stated by Hoover in his book, Concentrating Ores by Flotation.

Second.—There is a parallelism between certain electrostatic characteristics and the flotation properties of ores.

In the first mentioned theory, surface tensions and contact angles should be considered. Certain minerals, such as galena, will float on the surface of still water, while gangue particles, since they possess a greater adhesive attraction for the water than the water's cohesive attraction for itself, will be drawn through the surface film into the interior, and sink because of their greater specific gravity. These properties of flotable minerals and gangues are increased by the presence of oil and acid. Oil sticks to galena with greater tenacity than it does to silica, and an oil surface is still less easily wetted than a galena surface. The acid in the water causes a still greater difference in the various surface tensions. This it seems is without question the explanation of the action in the MacQuisten process, in which the ore particles are lifted to the surface, where they can be removed by skimming off the surface layer of the liquid.

With reference to the second parallelism it has been noticed that extremely small amounts of certain colloidal impurities, such as saponin or tannin, were de-

rimental to flotation; while others, such as Congo red and methylene blue, did not interfere, and were, if anything, beneficial. In classifying these, the injurious ones generally came under the head of what physical chemists call electronegative colloids, while electropositive colloids were not harmful. Suspended particles will generally migrate when placed in an electric field, and this classification comes naturally from the direction of their migration. This migration is called electrophoresis, or electrical endosmose, and is the result of the formation of contact layers around the particles by the liquid containing them, very similar to the formation of surface films when liquids come in contact with air. These contact films almost invariably have a difference of potential between their inner and outer surfaces. An air-water contact film has, for instance, a difference of 0.055 volts, and other contact films have similar charges. This causes the particles to act like charged solids, and to be attracted by electric charges of opposite sign.

The charges on solids and non-miscible liquids can be conveniently studied on the stage of a microscope.

This work naturally led to the study of the charges exhibited by various ores and minerals, and in that work an interesting parallelism was observed; namely, that flotable minerals seemed to have positive charges and non-flotable gangues, negative charges. Some gangues were found with positive charges, but they were characteristically hard to handle, having a tendency to come up with the froth. These charges sometimes vary with the acidity or alkalinity of the liquid, and this variation is not inconsistent with the effects of acidity or alkalinity on the flotation of ores.

It has been noticed that these electrostatic properties depend on the condition of the surface of the particle and not upon the composition of the mass. For instance, lead oxide which is ordinarily negative, or neutral, when covered with a sulphide coating, takes upon itself a positive charge.

Recent investigations on the coagulation and deflocculation of slimes, on the coagulation and dispersion of colloids, and along similar lines, show that these contact film charges, although small, have an important bearing on the dispersion or coherence of particles suspended in liquid mediums. In fine suspensions and in colloidal solutions, these charges may often be neutralized by the introduction of oppositely charged ions, precipitation generally taking place whenever these charges fall below certain limits. Oppositely charged contact films have a general tendency to coalesce, while similarly charged films, if their charges are great enough to overcome natural cohesiveness, do not seem to coalesce, [illegible] and if the weight of the particles is small enough in relation to their size and surface, permanent dispersion will take place, the particles distributing themselves through a liquid in much the same manner that gas will fill a container.

In view of the above observations, **it seems possible that flotation is the result of difference in polarity in the charges on the various ore particles, and on the bubbles.** Since oil contact films and air contact films have both been proved to have negative charges, the positively charged minerals will adhere to either [illegible] bubble mantles in a flotation machine are undoubtedly composed of oil, or of oil in emulsion, since pure water alone will not froth. The same forces then, that cause oppositely charged colloids to agglomerate and precipitate, cause the minerals to adhere to the oil-covered bubbles; and the same forces that keep the particles of an oil emulsion dispersed, keep the gangue particles repelled from the bubbles.

Expressed briefly, the theory is as follows:

That oil flotation is an electrostatic process. It is a scientific fact that when a solid particle is suspended in water, the water will form around the particle a contact film which generally possesses an electric charge, the amount and polarity depending upon the nature of the surface of the particle and the electrolyte in which it is suspended. The presence of these charges can be demonstrated by the fact that the particles possessing them will migrate when placed in an electric field. It has been demonstrated that flotable particles have charges of one polarity (positive), and that non-flotable particles have charges of the opposite polarity (negative); that the froth is charged negatively and so attracts the positively charged or flotable minerals, and repels the negatively charged or non-flotable ones. It is this, it is believed, that causes the flotable minerals, galena, sphalerite, etc., to adhere to the froth, and the gangue minerals, silica, etc., to remain in the liquid where they can be discharged as tailing.

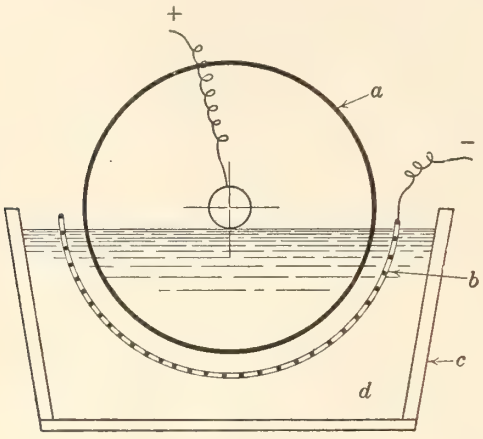
Discussion.

James A. Block, Salt Lake City, Utah.—As I have done some of the experimental work upon which this theory has been based, a brief outline of some of my experiments might not be out of place. During the last few months I have tested about 50 samples of ores, etc., the flotation characteristics of which I knew. Some of these were samples of froth and tailings from plants in actual operation, but most of them were samples taken from laboratory tests going on at the plant of the General Engineering Co., and at the station of the U. S. Bureau of Mines, Salt Lake City. In all of these experiments, no real exception to the theory was found. All of the tailing samples produced in actual flotation showed a negative polarity; all of the ores with the so-called "bad gangues," except one or two, showed some positive polarity, and these exceptions could be explained by the extreme dryness and sealiness of the gangue minerals; and all of the froth products showed positive polarity when the samples were fresh. It was often [illegible] that after standing some time, these froth samples would reverse, especially when they contained considerable oil, but this reversal can be explained if we assume that the oil forms a coating around the particles [illegible]

The question might naturally be asked, "can these electric charges be put to any practical use?" A machine* used to purify clays employs very similar charges on the constituent particles of clay. This machine (see Fig. 7) consists of a revolving cylinder, made of conducting material such as [illegible] immersed in a clay pulp in a trough. At a distance of about $\frac{1}{2}$ in. from the immersed side of the cylinder is a coarse wire screen. A direct current of about 50 volts was applied to the cylinder and [illegible] across the cylinder being the anode, and the screen the cathode. The cylinder [illegible] the negatively charged kaolin, while the screen attracts the positively charged quartz, iron hydroxide, and aluminum hydroxide. It was found that a product running only about 17 to 20 per cent. moisture could be stripped off the upper side of the cylinder, while it revolved slowly, while the impurities fell through the screen to the bottom of the trough. The objection to

*Transactions of the English Ceramic Society, vol. xi, pp. 53 to 59 [illegible]

the process was the high cost of the power needed, which averaged, as I remember it, over 30c per ton of product, but the process is undoubtedly of interest in that it shows that these electrostatic charges are dependable



a Revolving cylinder
b Wire screen
c Wood trough
d Clay pulp

Fig. 7—Apparatus used in purifying clays

enough to be put to practical uses. It is also of interest in that the polarity of the charges noticed on various minerals checks the results of the experimental work upon which this theory is based.

Oliver C. Ralston, Salt Lake City, Utah.—Perhaps the most interesting part of Mr. Callow's paper is the reference to a theory of flotation founded on the electric charges of the ore particles, oil droplets, air bubbles, etc., involved.

For some time I have had a growing conviction that possibly the particles dealt with in the flotation of sulphide minerals were acting according to certain laws laid down in colloid chemistry. One of the characteristic things about either suspension or emulsion colloids is that their individual particles are charged with one or the other sign of static electricity. It is known that the amount and signs of these charges can be controlled by the amount and character of electrolytes put into the water in which the colloids are dispersed, and in turn the properties of the colloidal suspension are greatly changed with this change in the electric charges on the particles. The question has been whether the comparatively coarse suspensions of ore can be compared with suspension colloids, or whether they were too coarse to allow the electric charges on the suspended particles of mineral to produce any measurable effect.

This question has been answered fairly definitely in my laboratory during the past year, for it was found that the electric charges on the particles of what we call "slimes" and "fines" are of considerable importance in the control of the rate of settling of such slimes in water. With this much definitely settled, and with a great amount of literature available in the realm of colloid chemistry dealing with the electric charges on particles of such things as quartz, galena, and sphalerite, and on oil droplets and air bubbles, it was easy to find a combination of circumstances which might explain flotation from this new viewpoint. At about this time George W. Riter made the prediction that the depths of electrostatics would have to be thoroughly sounded before flotation phenomena could be entirely understood. He seemed to have the idea at that time that the charges on the particles were generated by friction in the flotation machine, in much the same way that a piece of sealing wax becomes charged when rubbed with flannel; but we know from colloid chemistry that these charges of electricity arise whenever two substances of unlike dielectric constants come into contact.

Further work along the line of controlling the charges of the ore particles, thereby controlling the rate of settling of the particles in water, has convinced me that the charges are of considerable importance and the results of this work will be reported soon. Mr. Callow told me last spring that he had much the same conception of the matter as I, and had the Mellon Institute in Pittsburgh working on it for some time. Mr. Callow sent a man to the Salt Lake laboratory of the U. S. Bureau of Mines to try out some methods of measurement which I had proposed and which had not been used in Pittsburgh; some of the results are presented in Mr. Callow's paper. His work adds certainty to the conjecture that the electric charges on particles of minerals suspended in water are of importance in flotation phenomena. Mr. Callow has outlined one way of explaining just how these electrical effects come into play in flotation and I have outlined a second in an article in the Mining and Scientific Press. The knowledge that when flotation conditions are good the froth has a positive charge and the rejected gangue a negative charge, that the oil droplets and the air bubbles are negatively charged, and the sulphide particles positively charged is highly interesting. We have here electrical effects which are parallel to flotation phenomena, and the conclusion that they are connected with each other seems justifiable. Just exactly how they are connected is not yet clear and may prove difficult of solution.

It is to be hoped that further work will be done along this line in order that a theory of flotation may be found, which will afford a more rational control of flotation testing, and an extension of the process to the treatment of any kind of minerals.

MICA AT THE TETE JAUNE, BRITISH COLUMBIA.

Now that railways are being operated through the northern portion of Cariboo mining division, British Columbia, mineral occurrences in that part of the Province are attracting attention. The following notes relative to mica in the neighborhood of what has long been known as Tete Jaune Cache, some 30 or 40 miles west of the Yellowhead pass through the Rocky mountains, have been taken from a short report made by Mr. J. D. Galloway, Assistant Mineralogist for British Columbia:

The occurrence of mica near Tete Jaune has been known for many years, but practically no systematic prospecting or development work has yet been carried out. A number of claims have been staked from time to time and many are now held by annual assessment. I went to Tete Jaune at the end of September with the intention of examining some of the properties. On arriving there it could be seen that the mica claims, which are situated high upon the rocky ridges of the mountains at altitudes of from 5,000 to 7,000 ft., were covered with snow. I waited four days for the weather to improve, but it rained steadily in the valley and snowed in the hills. It was impossible to see anything of surface showings with such an amount of snow, so the attempt to see the claims had to be abandoned.

The following general description has been compiled from information obtained from Mr. Jowett, stipendiary magistrate, and from owners of claim: The mica

showings occur in the range of mountains above the south bank of Fraser river. The watershed of this range here forms the boundary line between Cariboo and Quesnel mining divisions. A very large pegmatite dike, or series of dikes, said to be 25 miles long and varying in width from 25 to 1,800 ft., is intrusive into the older rocks along the axis of the range, and extends from below Tete Jaune to Albreda summit, near Canoe river. This pegmatite, of course, is not exposed continuously along this length, but is sufficiently so to indicate that the different outcrops are linked together, at least not far below the surface. This pegmatite is the usual typical one, consisting of large crystals of mica, feldspar and quartz, with, in places, a fine-grained intergrowth of feldspar and quartz. The mica occurs in sheets up to 19 in. square and with a thickness, of numerous sheets together, of an inch to two inches.

The Albreda group of claims was worked for a short time in 1914, and in seven weeks three men took out from a surface quarry about two tons of mica which was taken down to Tete Jaune, where it was seen by me. This mica has a slightly brownish color, but in the thin sheets is quite transparent. It is to some extent stained with iron and the sheets are often striated and flawed; it is certainly good commercial mica, but is not of the highest quality. About 50 per cent. of the two tons taken out could be trimmed into pieces of 2 by 5 in., with, of course, some larger than that; the remainder would average about 2 by 3 in. It has an excellent cleavage and is not brittle, and could easily be trimmed as desired. It is mainly a muscovite mica, but some of it is considerably stained with iron.

A group of claims on the south side of Sand creek is owned by a French company, which during the summer of 1914 did some work, including driving a short tunnel. Other claims are held by Vancouver people.

It seems to me that these mica deposits are well worth careful investigation, and it is hoped that time will be available for a thorough examination next year.

GRANBY CONSOLIDATED

The Granby company had been credited with the ability to lay down its copper in New York at about 8½ cents per pound, but the quarterly statement shows the figure to be 11.9 cents per pound. The company's Grand Forks property has been known to be a high cost producer, but the new Anyox mine was expected to bring the average much lower than that shown in the Sep[illegible] quarter.

Officials of the company explain the situation as follows: Cost at Anyox was 7.939 cents per pound; at Grand Forks 10.91 cents, to which must be added [illegible]. These brought the Anyox figure up to 9.4 cents and Grand Forks to 12.4 cents, or an average of 11.9 cents per pound, after all credits for precious metal values. In other words, while Granby's report showed the expense of producing 12,000,00 pounds of copper to have been $1,823,827, an indicated cost of over 15 cents per pound [illegible] cents per pound.

The Grand Forks property is of lessening importance in Granby's operations, and its high cost is not surprising. High costs at Anyox were due in part to the installation of the fourth furnace at the smelter and the new agglomerator, [illegible] to operation.

Future costs at Anyox are expected to be much more satisfactory, as construction is practically finished. Furthermore, an increased recovery of about four pounds copper per ton of ore is possible with the new agglomerator. This should, of course, have a decided tendency to lower costs.

While Granby's report for the September 30th quarter showed net profits of $486,435, the actual results have turned out to be considerably better. The preliminary figure was based on an inventory value of 15½ cents per pound for 8,385,100 pounds of unsold copper, which has since been disposed of for $168,000 more than the inventory value. In other words, net for the quarter was $654,000 instead of $486,000 as shown by the report.

COLLECTIONS OF THE EMPLOYEES OF THE DOMINION COAL CO. TO THE CANADIAN PATRIOTIC FUND.

Collections through the payrolls of the Dominion Coal Co. on behalf of the Canadian Patriotic Fund were commenced during November, 1914, and with the end of October twelve months have gone by, during which time the aggregate contributions of the workmen have totaled $8,025.16. The collections for the month of October totaled $936.00, this being the highest figure obtained since the collections were commenced. The amount of eight thousand dollars does not include any of the larger sums which were contributed to the Patriotic Fund by officials of the company when the campaign for funds was first inaugurated, but is altogether made up of small sums contributed monthly. It is interesting to note that the monthly contribution has steadily increased notwithstanding the steady diminishment of the company's employees by recruiting.

The amount collected for the Machine Gun Fund totals $8,000. The workmen of the Dominion Coal Co. have therefore contributed $16,000 to patriotic purposes during the year, and from among their ranks some 1,500 men have gone to the front.

KENNECOTT COPPER

With 167,972 shares standing in his name, Daniel Guggenheim leads the list of Kennecott Copper Corporation stockholders. During the few months intervening since the company was formed its shares have been distributed to more than 800 persons. On the [illegible] by Kennecott, has in excess of 2,600 stockholders; but this company has been in existence for years.

[illegible] all being dominated by the Guggenheims. Kennecott was owned entirely by the Alaska Syndicate, [illegible] J. P. Morgan & Co. A portion of the Guggenheim participation was several years ago turned over to Kuhn, Loeb & Co. M. Guggenheim's Sons are believed to have been the controlling factors in Braden, which [illegible] Exploration Co. will dissolve after distributing its [illegible] Utah Copper to Kennecott.

EUROPEAN MINING FINANCE*

By J. L. Gallard.

Considerable progress has been made during the last few decades in connection with the formation of companies to develop mining properties, and London, the world's chief money centre, has assisted in no small degree the attainment of that progress. The other European money centres have, of course, contributed also, but not nearly to the same extent as London. Here, as elsewhere, the promotion of mining propositions has for the present been checked by the great European War now in progress and maybe some considerable time will elapse before anything like the former activity is witnessed again. There are the important facts to be remembered, however, that the war is dispersing huge quantities of the products of the mining industry; that when peace reigns once more mineral products will be needed in great quantities in connection with the re-establishment of other industries; and that although the supply of capital for purely speculative enterprises will not be so great as before, legitimate schemes having for their object the opening up of fresh mineral resources are hardly likely to be left without support.

Before proceeding to deal with the requirements and methods of British promoters of mining companies, it may be of interest if I illustrate the very important part European countries and their foreign possessions play in connection with the mineral production of the world. Quite complete and up-to-date statistical data relating to the output of the various parts of the world are not available, but information is given in a portion of the report recently issued by the British Home Office which enables one to gain an idea of the position. For instance, in the report mentioned, there is a table of statistics which shows the number of persons engaged in mining and quarrying at home and abroad. This compilation is incomplete, inasmuch as no figures are published by several countries, viz., Bolivia, Brazil, China, Persia and Turkey; so that the total of nearly six and one-half millions in the table probably falls considerably short of the real aggregate. However, the figure is instructive, especially when one analyses the returns and discovers that European countries and their foreign connections represent just over five millions, or 77 per cent. of the total. Turning then to the statistics relating to the annual production of the most important minerals, we find that nearly 63 per cent. of the world's output of gold is contributed by European countries and their colonial possessions, and that of this 63 per cent. the British Empire is alone responsible for almost the whole. More than half the total number of mining employees being engaged on coal mines, the output of that mineral naturally ranks first—a long way first—as regards quantity; and here also we find European influence strong. Although America produces more coal than the United Kingdom, the latter, together with other European countries and their possessions abroad, figure for rather more than 60 per cent. of the aggregate for the whole world. They also contribute over half the iron. On the other hand, North America has the "pull" as regards petroleum, and also produces more than half the world's output of silver and copper.

While rough calculations such as these are interesting, they do not, of course, fully illustrate the scope of the subject of European mining finance, which is, in fact, as wide as the geographical distribution of the world's mineral resources. Political boundaries do not greatly concern mining financiers, who, as a rule, are ready to seize upon a likely thing in any country, literally "from China to Peru." **The promotion of mining enterprises is, in fact, largely a matter of opportunity coupled with financial resources and more or less technical knowledge.**

Conditions change from time to time in the world of mining finance, just as they do in other spheres of activity. One year, perhaps, sees an increase in the number of gold mining companies formed, another year copper rules the roost, or, maybe, alluvial tin schemes predominate. To a large extent the class of mining companies promoted is determined by the swing of the pendulum on the London Stock Exchange, where, by the way, sentiment always plays a part. Mining financiers of standing, being in a position to bide their time, are usually prepared to consider schemes and take over the good ones, whether they happen to coincide with the Stock Exchange fashion of the moment or not; whereas the smaller fry, with limited, and possibly very attenuated, financial resources, can hardly afford to do so. The latter, however, generally manage to get hold of something when a Stock Exchange boom is on, and this accounts for the flotation of "prospects," which, in the absence of great speculative excitement, would stand little chance of attracting public money.

In London the promotion of mining companies of any size is undertaken, as a rule, by one or other of the numerous exploration or prospecting syndicates, or companies, which have been formed specially to deal with business of this kind. Mere "prospects" are not run after. A developed mine, having some ore actually in sight and a satisfactory outlook, stands probably the best chance of being taken up. It is true that many of the now well-known mining companies operating on the famous Witwatersrand gold field were formed and provided with working capital before the sinking of a shaft on their ground had even been commenced, but that field has always been regarded as unique in having a comparatively regular reef formation. Apart from this, mining promotions were more readily made on slender data in those days than they are now, except, perhaps, in boom times. Another type of proposition likely to be given careful consideration by mining financiers of standing in London—who, by the way, include some well known citizens of the United States—is the mine, which, after being worked in the somewhat distant past, was abandoned for metallurgical reasons or because metal prices fell to too low a level to permit of the property being profitably exploited any longer. Evidence must be provided, however, that it was not left because the lode pinched out at depth, and it must not be a very deep water-logged mine. In the case of a property whose workings extend only a short distance beyond the oxidized zone and where the nature of the formation lends itself to the testing of the sulphide zone by means of bore-holes, and the old records indicate that the former workers gave up on account of their being unable to treat the sulphide ore, then the presence of water in the old workings would not be regarded as a great drawback; and, providing satisfactory terms could be

*A paper presented at a meeting of the International Engineering Congress, 1915, in San Francisco, Cal., Sept. 20-25, 1915.

arranged, the proposition would, in all probability, be taken up with a view to the formation of a company.

Many mines are taken up, in the first instance, under option. Of these, the proportion that comes eventually before the mining public is probably not very great. Many are optioned, but few are called. In this connection, the interesting case may be cited of a mining finance company whose shares rose to a high price on the London Stock Exchange last year, solely on the strength of the fact that it appeared to have secured a piece of business having great potentialities. Before that business was secured, however, the management had investigated and turned down between four and five hundred other propositions!

What has become of the rejected, someone will wonder. Well, they will probably be, if they have not been already, offered elsewhere, and very likely some of them will eventually appear before the mining public; for when a Stock Exchange boom is in progress, as previously mentioned, properties find a market much more easily than in normal times. It does not necessarily follow that all the rejected were worthless. Some no doubt had considerable merit, but the vendors probably opened their mouths too wide, and the fact of their having been turned away may have done good by modifying their ideas of values.

The question of price is one of the great difficulties in connection with the placing of mining properties. Vendors usually think that their geese are swans, and are, consequently, apt to regard the people who are considering the question of financing the mines as nothing better than thieves and robbers. No doubt this attitude accounts for many a promising mine being turned down—at any rate, temporarily.

The Financing of Mines.—Having secured the offer of what appears to be a promising mining proposition and arranged for a working option, the exploration or finance company with which the financiers are associated will start work thereon, and if at the end of the option period the results are satisfactory, the option will be exercised and the mine taken over. Probably the vendors will have stipulated for a share interest in any new company that may be formed to acquire and work the mine, in addition to a cash payment. Market conditions being propitious, a new company probably will be formed. Sufficient working capital may be guaranteed by the parent exploration company and its associates, themselves, taking up shares at par, in which case it may be thought unnecessary to incur the expense of making an appeal to the public by means of a prospectus. Instead of issuing a prospectus it may be decided to have the shares introduced on the Stock Exchange through the medium of a firm of brokers. (The prospectus and non-prospectus methods will receive further consideration in a subsequent portion of these notes.) In the event of an offer of shares to the public being decided upon, there will be underwriting arrangements to fix up, and these will probably be made with friendly mining groups and Stock Exchange firms. Underwriting commissions are usually payable in cash. Sometimes they take the form of an option for a period on a portion, or on the whole of the unissued shares at par, or some other fixed price. A good clue to the quality of the proposition whose shares are offered to the public is often afforded by the size and nature of the commission payable to the underwriters.

As regards the capitalization of mining companies there is no definite rule as to size. But there is a rather common failing, namely that nowadays large nominal capital of a company may be, it more often happens that the working capital is inadequate than the reverse. Too often the size of the capital is determined, not by the immediate and prospective requirements of the mine, but by the rapacity of the vendors and the promoters, who are guided to some extent by their judgment of the capacity of the public at the time. Of course there should be some relation between the size of the mine, its ore reserves, its possibilities of extension, its financial requirements, and the amount of capital the public is asked to provide in order to pay the vendors and to furnish resources for the working of the property. But hard and fast rules cannot be laid down which would meet the requirements of all, or even a fair proportion of mining finance schemes. No two mines are exactly alike, nor have any two groups of mining financiers exactly the same ideas.

Several companies in recent times have followed the lead of a number of the South African gold mining concerns and have raised large sums of money on debentures. In some cases, these debentures carry conversion rights, that is to say, they can be exchanged for shares in certain fixed proportions. This gives the holder of debentures a chance of securing some return in addition to the fixed rate of interest, and if the company is successful it stands to get its debenture debt reduced automatically by the conversion rights being exercised. In a recent case, debentures were offered for subscription, carrying, in addition to conversion rights, an option on shares at par for a fairly lengthy period. If these options are exercised, the company will, of course, receive a further supply of capital.

The debenture method of raising money has an advantage over that of issuing cumulative or participating preference shares. Dividends on shares can be paid only out of profits, and the earning of profits usually means the attainment of a fairly advanced stage of operations. Debenture interest, however, can be paid out of capital, pending the attainment of the productive and profit-earning stage. Of course, it is not every mining concern that can justifiably raise money on debentures, and this method, like many others, is liable to be abused. One or two cases have come under my notice where the so-called debenture bonds offered for subscription were really no better than ordinary [illegible] enough to ward off the public.

Limited Liability Companies.—The [illegible] undertakings by means of companies is, by the way, almost as old as the hills. Mr. H. C. Hoover, in one of his many publications relating to the formation of [illegible] mentions that the ancient Greeks formed companies to work the silver mines of Laurion, and that company organization was very common among the Romans, who regulated largely in the same [illegible] from these ancient methods of conducting operations on companies from here [illegible] adopted the methods in general use [illegible] the principles underlying the adaptation of the principle of limited liability [illegible] was not [illegible] generally adopted throughout the British Empire, [illegible] is probably [illegible] that nearly the bulk of the British capital [illegible] or more or less [illegible] represented by shares in companies having [illegible] limited at the end of their title. Though [illegible] may be private and not public [illegible] other European countries [illegible] are also held [illegible]

been registered either in Great Britain or in British colonies under the limited liability system.

"Limited liability" means, of course, that the holder of a share is not legally liable for calls amounting to more than the face, or nominal, value of that share. In the event of more capital being required, when all the company's shares are issued and are fully paid up, some scheme may be devised for "raising the wind"—a reconstruction involving a fresh assessment being the common plan—but the holder of a fully-paid share can refuse to assume any further liability. In that event, he is entitled to have his interest in the concern bought out, but in practice this rarely means that he gets anything worth having. At the same time, the holder of a partly-paid share remains legally liable, so long as he holds that share, for the amount of the outstanding calls, and even forfeiture of the share does not release him from this liability.

Mining and the Stock Exchange.—Mining for tin, copper, lead and blende had been carried on in Great Britain for centuries; the huge deposits of coal and iron had attracted large amounts of capital; and millions had been found for the exploitation of gold mines in South Africa, America and Australia; but previous to the great South African boom of 1895 the mining section of the London Stock Exchange was a small and unimportant affair. Many brokers, as well as people outside the Stock Exchange, looked askance at anyone who talked of dealing in mining shares, which was regarded as gambling and a vice, and it was not until the year mentioned that public interest in mining ventures became widespread. A remarkable change then came over the scene. Continental as well as British investors poured enormous orders into London for South African shares, and ever since that memorable time the investment of money in mining enterprises has assumed a different aspect—at any rate, amongst the British public.

Statistics published by the Mining Journal of London, relating to the incorporation of new mining companies, show that in the ten years, 1893-1902 inclusive, the number of companies registered in London was 5,482, and their aggregate capitalization was £582,915,449. Of these, 950 companies, capitalized at £56,234,626, were for operating in Great Britain, and were for the most part connected with iron and coal mining. The other 4,532 companies, with a total capitalization of £526,680,823, were formed to carry on operations abroad. In the year 1895 close upon 150 companies, with a capitalization of about 18¼ millions (£18,250,000), were formed in England in connection with the South African gold mining industry; while in 1895 and 1896 some 700 companies were registered in London, with a capital aggregating £72,000,000, in connection with the gold mining industry of Western Australia. The comparatively small number relating to the Transvaal is explained by the fact that the majority of companies which were formed to exploit the "banket" beds of the Witwatersrand gold field were registered in the Transvaal, not in London. The mining claims there, after being taken up by local syndicates or by finance companies like the Consolidated Gold Fields of South Africa, Limited, were floated off and the shares of the separate companies were placed on the market, usually at a substantial premium. Several of the mines at Kalgoorlie, Western Australia, were originally floated in Adelaide, but later British companies acquired the interests of the Colonial concerns.

No doubt there are still some people who regard dealing in mining shares as a form of vice, while probably some of those who indulge in speculative purchases would frankly admit, if asked, that to them it is merely a form of gambling. But the old prejudice has worn down under the pressure of a growth of knowledge respecting mining matters. It has come to be more generally realized that the mining industry has played an important part in connection with the civilization and material progress of the world, a part it is still destined to play; and one of the chief requisites of the mining industry, of course, is capital. I have heard it deplored that mining and speculative activity in shares should be so linked up together. Idealists have gone further and have contended that the mining industry should be entirely disassociated from the Stock Exchange. How then would the requisite large sums of capital be found? Eliminate the chance of making profits by dealing in shares, and probably only a very small proportion of what may be termed the mining public would be ready to embark its capital in mining ventures. Few of those who provide capital for the opening up of mines do so with the intention of simply holding on to their shares until they die or until the company they are interested in ceases to exist. Human nature being what it is, and the millennium being still in prospect, mines and share-speculation will probably continue in association; and it seems to me that the best thing to do in the circumstances is to try and educate the mining public, so that it will be able to discriminate between good, fair, poor, and absolutely worthless propositions.

Mining Prospectuses and the Public.—One outcome of the growth of public interest in mining shares during the last twenty years is that mining prospectuses are, as a rule, more carefully compiled nowadays. In the so-called "good old days" more was thought of presenting an attractive "front page" than of providing essential data as to the mine. By an attractive front page was meant an imposing list of directors, and an imposing list of directors meant a number of titled individuals. Such things as "ore reserves" and "profit in sight" were hardly thought of then. Now, more information is expected about the mine whose shares are offered for subscription, and a company is not cold-shouldered because the directorate does not include a duke, a marquis, a lord or a baronet. The appearance on a board of directors of one or more well known mining engineers is much more important, and if, in addition to such a directorate, there is a technical committee, composed of mining and metallurgical experts, so much the better. Then as regards the inside of a prospectus, a report of the property, solely by the vendor's engineer, is not sufficient. An independent engineer's report should be forthcoming, and, assuming that the mine is already opened up to a certain extent, he should provide an estimate of the quantity and average value of the ore fully and partially developed. It will then be possible for the potential purchaser of shares to form an idea of the reasonableness, or otherwise, of the consideration payable to the vendors. If it is an alluvial venture, an estimate should be provided of the available yardage and its metal contents; the latter based on the results of the bores or pits, the number of which should be stated.

Fine phrases which really mean nothing are, unfortunately, not always left out of modern mining prospectuses; while every now and then one comes across a document containing extravagant statements printed in large type, which, the promoters no doubt fondly hope, will make up for the absence of convincing data.

A fair number of the public, however, now know at least a few of the tricks of the trade, having learnt a little by experience—costly experience, it is to be feared, in many cases. But there are many, apparently, who are unable to profit by experience, and so long as a gullible class of people remains in existence the promoters of dubious and downright shady schemes will ply their trade with more or less success. As the saying goes, "you can fool all the public some of the time, but you can't fool all the public all the time." It is those who can be fooled more than once who help to keep a market boom going.

The credulity of a portion of the mining public is really amazing. It is curious how able men of business seem to lose their business acumen once they get outside their own particular line. I have heard of numerous cases of men in responsible positions in the world of finance and industry who have lost money over mining propositions they ought never to have touched. A glowing report on an alleged mine in a remote part of the world, written by a man they never heard of before, but brought before their notice by a plausible individual able to conjure up visions of easily-gained riches, will often charm money out of the pockets of ordinarily cautious and capable business men. A fine assay result seems to be especially efficacious in such cases. In their haste they overlook the obvious fact that one specimen does not make a mine. It is also curious that once bitten does not make them twice shy. If a market deal goes against them, they will very likely "average" their shareholding in the concern, regardless of a change for the worse in the condition of the mine; while in the event of their being badly treated by the directors, who, perhaps, have withheld material information, they will probably not kick up a fuss, for the reason that they do not want to advertise the fact that they have been foolish. Unfortunately, people like these help to sustain the very promoters and directors the world of mining finance could do best without.

Prospectusless Companies.—Many companies which are really dependent upon public support for the provision of working capital do not issue prospectuses. Their shares are "introduced" on the London Stock Exchange, generally at a premium, and by means of advertisements in the papers public attention is called to them, though as a rule no efforts are made to obtain subscription. This method has advantages from the promoter's point of view. For one thing, and it is not the least important, this method enables the promoter to dodge the Companies Act. British Company Law requires a prospectus to set forth certain essential details, such as the terms of the underwriting of the issue, the consideration payable to the vendor, the participation of any intermediary vendor, the minimum subscription on which the directors will proceed to allotment, and the personal interest in the promoting or underwriting syndicate of each of the directors. Moreover, the directors are jointly and severally liable for the accuracy of the whole contents of the prospectus. The memorandum of Articles of Association of the Company must also be printed with the prospectus. By getting his company's shares "introduced" on the market—through a firm of brokers to whom blocks of shares are options at rising prices—the promoter avoids the necessity of making such disclosures. Usually, printed slips giving brief particulars of the enterprise are circulated in the market, but these slips are unsigned and apparently no one can be held legally responsible for their contents. The stock exchange authorities, it is true, require an undertaking from the promoter that he will make no misrepresentations to the unofficial market, and the provincial brokers who deal in shares; and the provincial brokers who deal in shares; and the provincial brokers who deal in shares;

ployed are given shares, at a discount, to dispose of amongst their clients, on the understanding that if any of the shares they sell come back to the market within, say, three months, they lose their commission on the sale of such shares. It is impossible to place any shares, on a large scale, amongst the public in France without a market quotation being obtained for the shares; and from this follows the expenditure of money amongst the newspapers.

The Russians are not credited with much mining knowledge, but it is said that they will follow a good lead and buy mining shares. "Ore reserves" and "profit in sight" are unfamiliar terms to them, and they will call a "mine" what is merely a "prospect." A number of Russian mining propositions have been financed in Great Britain during the last five or ten years, and the probability is that more will be done in this direction in the not distant future. It is usual, though the method has not been invariably adopted, for a British-formed company to hold the bulk of the shares of a Russian-formed company, the former being the holding and the latter the operating company. This method is considered to have several advantages. Anyway, it is necessary to have a Russian manager at the mine. When it comes to negotiating with the Government and dealing with labor questions, the fact of there being influential Russians on the board of a local company should certainly prove advantageous; while from the share-dealing point of view there is the fact that the dual arrangement means two markets, one in Petrograd and one in London. The technical control of the mining and metallurgical operations, however, is not left to Russians. This is usually in the hands of engineers in London, who make periodical visits to the properties. The option method of financing mines has been taught the Russians by the British; but the latter might adopt, with advantage, probably, in many cases, one of the provisions of the Russian Company Law which requires the founders of a company to subscribe not less than one-tenth of the shares, in the case of a million roubles capital or less, and when the capital exceeds a million roubles, one-twentieth of the shares over and above that number.

The Future of Mining Finance.—The more actively the world is searched for mineral deposits, the smaller becomes the chance of promising new propositions being located; and the prospect of those who every now and then cry out for a new mining field having their request granted is rendered gradually still more remote. But it may easily happen that before the fresh fields and pastures new are located, mining financiers will find some of the fields already known to them affording fresh scope for their activity. In this connection two points come to mind at once. In the first place, the famous Witwatersrand gold field is not yet fully developed. Mr. R. N. Kotze, Government Mining Engineer, Union of South Africa, in course of the evidence he gave before the Dominions Royal Commission, in April last, said that the quantity of payable ore in the undeveloped areas of the Witwatersrand was equal, in all probability, to the quantity remaining in the producing mines. (His estimate under the latter heading was 587,000,000 tons.) And he estimated the capital requirements at, roughly, £50,000,000. Then there are the great mineral resources of Russia. British capitalists have already interested themselves, more particularly during the last few years, in these, and are looking forward to the time when they will be able to take a more active part in connection with the development of the Russian mining industry, which, according to people well acquainted with that country, is likely, after the war, to assume a much more prominent position than it has attained up to the present. So far as the early future is concerned, the prospects of activity in the world of mining finance are not bright, on account, of course, of the European War. But there is still plenty of scope for the mining financier, and when peace reigns once more he will find business to his hand.

Some of the more recent developments which have been noted in connection with mining finance and company organization in London encourage a feeling of optimism in regard to the future. Evidence is forthcoming that in some quarters directorates are now being more carefully selected, and that better technical control at headquarters is being provided. These factors must result in improved technical management of the mines. The more widely improvements such as these are adopted, the smaller will become the danger of "scandals," which do harm to the mining industry by checking the supply of public money for legitimate schemes, and the more difficult it will become for the purveyor of "wildcats" or "fakes" successfully to ply his nefarious trade.

CANADA COPPER CORPORATION

Canada Copper Corporation has put into reserve 9,000,000 tons of ore averaging 1.8 per cent. copper, in addition to which 2,000,000 tons of "probable ore" has been located. Exploratory work continues with three diamond drills in operation.

Not only does the Canada Copper Corporation own a big copper area upon which it is pushing development work, but it also controls the British Columbia Copper Co., which is operating one of its three furnaces and showing a fair profit.

Before production can be inaugurated at the new property milling facilities must be provided, it being the intention of the management to erect its own mill with a capacity for treating 2,000 tons of ore daily. This will necessitate new financing.

The method of financing has not been determined, nor the amount, but it will provide for the elimination of the outstanding $600,000 debentures which still have eight years to run.

Engineers report that there have been developed to date at Copper Mountain 8,900,000 tons of "proven" ore averaging 1.75 per cent. copper and 2,000,000 tons of "partially" proven ore averaging 1.75 per cent., or a total of 10,900,000 tons, and an estimated recoverable value of 20 cents per ton in gold and silver. Erection of a 2,000-ton plant is recommended. Canadian Pacific engineers are assured of the advisability of running a spur to the mines from Princeton, 12 miles.

Work at the old properties in the vicinity of Greenwood, B.C., was resumed last August and a fair profit is being realized as a result of the smelting operations now in progress. The Greenwood ores are smelted direct, whereas the Copper Mountain ores are of the disseminated porphyry type and will require concentration by flotation process.

It is estimated that a maximum of $2,000,000 will be required to place the property on a 2,000-ton basis. It is estimated that cost of production during this stage will not exceed 8.5 cents per pound of copper after crediting recoverable gold and silver values and the cost of production from the deeper ores will not exceed 10.5 cents per pound.

THE MINES OF THE BRADEN COPPER CO.

By H. R. Graham.

"El Mineral Teniente", property of the Braden Copper Co., is situated on the rugged slopes of a part of the main Andean Range in latitude 34° South, and longitude 71° 20′ West, at an altitude of about 8,000 ft. The property consists of about 100 claims covering roughly 1,200 acres. The mine is a very old one, dating its history back to the 18th century, when a Spanish lieutenant endeavoring to reach the Argentine from Chile in order to escape the long arm of the law, discovered a high grade vein in that part of the mine now known as Teniente No. 1. The mine operations up to 1906, however, were on a very small scale, and consisted of a gopher system of mining rich veins, concentrating the contained metal by hand sorting, and transporting it about fifteen miles by mule-back for direct smelting. At that period the operations of the American company commenced in earnest, and from that time on the mine has gradually been enlarged, until it has attained its present 3,000 to 3,500 ton daily output.

Geologically, the property is peculiarly interesting inasmuch as it consists of a series of irregular lenses formed about the periphyry of an old volcanic plug, slightly tilted to one side. On one edge the surface has been so eroded, as to have lost completely its mineral values; for active mining operations about four-fifths of the circumference of the crater is left. The volcano itself would rank as a fairly large one, having a diameter of about three-quarters of a mile, and a roughly circular outline about two and a half miles long. Supposedly of Tertiary origin, the country about the mine consists of andesitic flows, through which, at the time of some gigantic volcanic upheaval, the tuff plug now occupying the crater, was forced. The great pressure tore apart and shattered the andesite flows, much as a missile thrown through a plate-glass window would affect the glass. The uprising hot alkaline carbonate waters, containing mineral sulphides in solution, found the cracks and minute fractures in the andesite an ideal place to precipitate, upon the lowering of temperature and release of pressure, and found their way for some distance out into the shattered rocks away from the crater.

The materials close to the eruptive center were so thoroughly shattered that they formed a brecciated deposit, making a most favorable point of deposition; and it is in the brecciated portions of the lenticular orebodies that the greater values are found. Mineral sulphides, however, formed ore even in the blocky andesite at some distance from the crater. Generally speaking, the materials with which the miner is interested, are the tuff, composing the volcanic plug, a combination of volcanic mud and contained agglomerate; the breccia, essentially of tourmaline ground-mass with inclusions of angular andesite fragments; and the andesite, mineralized except close to the breccia contact or at such points as fumarolic veins have been formed. The actual contact between the tuff and breccia is not always distinct, but if one remembers that the tuff includes rounded fragments of porphyry, and the breccia angular fragments of andesite, the difference is easily detected.

The contact between breccia and andesite is easy to note as a rule, but on the Teniente side the gradation from shattered andesite to andesite breccia, is a most perplexing one. The breccia does not always appear as an intermediate material between the tuff and the andesite, but in these cases where tuff and andesite contact, the ore width is not so great nor the values so rich. At various places in the mine old fumaroles are encountered, in which oxidation has taken place at depth, and at times small chambers containing heads of wire copper coated with oxide, are found in company with the usual black sulphides and oxides and yellowish iron stains of limonite.

The limit of ore on the crater side is generally the tuff, although sometimes false contacts—thin tongues inserted into the breccia—occur, on the inside of which there is good ore bearing breccia. On the country-rock side, the limit of ore has to be determined by assay, but is also detectable by the lessening of the fractures and the blockier, more massive appearance of the andesite.

The copper values occur in both breccia and andesite, essentially as primary sulphides in the form principally of chalcopyrite, which is roughly 75 per cent. of the copper mineral, and also as bornite, secondary chalcocite, an undetermined black sulphide between tetrahedrite and enargite, and some of the carbonates, silicates, sulphates and oxides of copper. Zinc blende, iron pyrites, magnetite, galena and occasionally native copper are also found. Tourmaline, quartz, calcite, ferro-magnesium carbonates and the usual products of devitrification, chlorite, kaolin, etc., are also found, as well as the plagioclase, biotite, hornblende and pyroxenes of the different classes of andesite.

The topography, due to violent igneous origin of the region, is very steep and rugged, devoid of vegetation, particularly liable to strong winds, heavy snows and snowslides. It is this topography which at one and the same time aids mining, drainage and ventilation, by allowing the mine to be opened by adits, and still makes difficult the operation, by its lack of safe room for buildings and storage of supplies, and by its difficulty of access.

Great care has to be exercised in the choice of building sites, as we have found by experience that the Cordillera guards its wealth rather jealously, and one bad storm is sometimes enough to change all previous slide paths and wipe out even buildings that have stood up for years.

The surface plant consists of a power house, with necessary compressors for a steady compression of 6,500 cu. ft. of free air to 100 lb. pressure; motor generator sets, for the transformation of about 600 kw.; and switchboard installation for handling of about 1,500 kw. at a 2,300 voltage. Power is sent from the substation at the Canon Diablo (two kilometers) by two separate pole lines, which are about 10 miles long, line to line.

The machine shop is fully equipped with lathes, a shaper, drill presses, pipe machines, shears and a punch, and takes care of mechanical repairs. A blacksmith shop, complete with forges, an air hammer, rolls, drill sharpeners, etc., attends to all heavy work and drill sharpening.

The carpenter shop with [illegible] a planer and a wood working machine, does all the carpenter work and

*Extracts from an article published in Technical Topics, 1915, [illegible]

the bodega, almacen and bakery see to the supply of necessary materials, both for the work and living.

All water necessary for plant use, drinking, washing, and sanitary purposes, is secured from the so-called Teniente lakes, some 500 meters from the Fortuna No. 4 tunnel, and is supplied to the upper levels by pipe lines from a pump on this level.

All power, light, telephone and air lines are carried underground to avoid snowslide and wind danger. Communication is secured between all levels both by underground workings and by aerial tramways, by means of which supplies are delivered. An electric railroad connecting the lowest level of the Mine No. 5, with the coarse ore bins at the mill delivers the mine ore, and at the same time brings up the greater part of the supplies. The aerial tramway, connecting the mine and mill now called Sewell, in honor of the late persident of the company, is used almost entirely as a store delivery system, but in cases of emergency can deliver ore. It is at present motor driven, handling ore occasionally.

The equipment, consisting of the necessary motors, compressors, shop tools, haulage motors, cars, drills and accessories, were all sent from the United States; the labor has been practically all Chilean.

The main townsite, populated by some 1,000 people in winter, and about 1,500 to 2,000 in summer, is accommodated on the several small hills bounding the snowslide gulches, and is called the "Pueblo Hundido." It consists of a general office building, hotel, engineering office, assay laboratory, three staff houses, three cottages, one large stone building accommodating several families, and about ten rows of buildings composed of two-room family quarters, men's bunk houses and boarding houses.

On the upper levels of the mine live between 500 and 800 people, who are housed either in large rooms cut in the rock, or else in wood and calamina houses perched on the hillsides.

The mine has three principal orebodies: the Fortuna, the Regimiento and the Teniente, with a total tonnage of about 90,000,000 tons, developed and probable, with good prospects for largely increasing this tonnage by future development. The two smaller orebodies, of secondary importance, but included in this tonnage are: the Centinela, and the Bornite. The Teniente orebody is now being developed to an operating stage. The full extent of ore in this section has not as yet been determined.

The Fortuna orebody, from which all the ore at present is being won, is operated by the principal levels; Fortunas Nos. 2, 3, 3½, 4 and 5, and by sub-levels Nos. 2½, 3¼ and 4½. With the exception of levels Nos. 3½, 4 and 4½ shrinkage stoping operations have been nearly completed, and caving is now in progress.

The mining divides itself, naturally, into three important operations, viz.: Development—finding and proving what deposits there are and their extent. Stoping—the preparatory weakening of the great orebody; and Caving—the final step in the ore recovery. All these operations are now going on in the mine.

Development work consists of driving adits along the contact of the tuff with breccia or andesite in order to locate the ore; and then when once located, to determine the tuff contact, or one side of the ore, by crosscutting, and also the limit of commercial ore on the opposite side. Once ore is reached, these crosscuts are put in about every 34 meters, and in this way, blocking out every 100 feet, the plan area of the ore at that level is determined. The extent of ore was first determined in the Fortuna on the No. 2 level, then blocked out on the No. 3 level in the same manner, and the ore between them proved up by inclined raises running from the tuff to the limit of the commercial ore and back, to ultimately connect to the level above. The tuff side is commonly known, because of its inclination, as the hangingwall, and the limit of commercial ore as the footwall. After a block of ore is outlined, the crosscuts used in developing the body are utilized as starting points for the actual mine operations. In these crosscuts small raises, at from seven to eight meters centres, are driven up into the ore at 45° until the face of the raise reaches the far side of the stope. In some cases, this is ten meters on the incline in the old system; in the present Teniente system it will be about five meters. When this drive is completed, a timber chute with an arc gate is erected. A machine of the standard hammer drill stoper type is put to work; and these various raises are connected, one to the other, by a belling out process, which ultimately leaves a series of circular holes. These at last extend across the orebody, the hole on the hangingwall side showing tuff, and the hole on the extreme footwall end assaying the commercial limit.

In the meantime, in the pillar left between each two of these sets of openings, an inclined raise has been driven, and at a point about twelve meters vertically above the level a horizontal working, known as cruzado, is driven from the raise to the room formed by the joining of all the chute holes. This room is known as a stope. It is really a big underground room, of a width depending on the kind of rock, but generally 22 ft., and a length dependent on the width of the orebody, but ranging between 60 and 350 ft.

Stoping.—Once the cruzado is connected the chutes are allowed to fill up with broken ore, and after that all communication between stope and level is by these cruzados. The stope is filled with broken ore to within about six to eight feet of the back, and then trimmed into shape by means of carefully placed holes with the hammer drills. Pipe lines are run up the inclined manway raises, and by means of wire wound hoses, air is supplied to the rooms for ventilation and for the operation of the hammer drills. Once the stope is "lined up," machine drillers start work in the ratio of about one drill to every 40 ft. of stope length. An average drill shift consists of fifteen 5 ft. holes per machine, which should break with one and a half sticks of ordinary 34 per cent. Gelignite per hole, about 60 tons of average stope rock. On the principle that each cubic meter of rock in place occupies 1½ cubic meters when broken, it is possible then to draw out 24 tons for each 60 tons broken, and leave the same 6 to 8 ft. between the unbroken back and the broken ore pile. No holes are drilled in the centre of the stope, but each drill, safely placed at the extreme wall of the stope, drills one vertical hole, and one slightly inclined hole toward the centre of the stope. Then at a 5 ft. distance, the miner drills two more similar holes, and continues thus until his shift is over. By alternating this process from one side day shift, and the other side night shift, a great deal of rock in the centre of the stope is robbed of its side supports, and has to fall by itself, which tends to cheapness. All stope work is done on contract price per foot of hole. Additional men are employed to deliver steel to the stopes; mechanics repair machines and keep air lines in shape; and on the level below, hand trimmers of motor haulage cars continually draw off the excess break to leave the working space necessary between the back and the ore pile.

This stoping operation goes on continually, raising higher and higher on the broken rock, until the back

reaches a point some 30 ft. below the level above, at which point a final blast to fill the stope is placed, and the work discontinued. The raises in the pillars are continued to connect to the level above for ventilation, and as one pillar raise is run in the hangingwall end, and in the next pillar in the footwall end, each stope always has at least two entrances and a continuous natural ventilating draft. The drillers load and blast their own shots, and each shift at 15 minutes before quitting time, has all its holes ready to spit. When the raising of stopes is finished, the stopes are left filled, until caving operations above have been completed.

The best arrangement of stopes as developed here, to suit the ground, and as will be used in the Teniente, is to have a seven meter stope and a five meter pillar, which in the case of bad ground can be changed by narrowing up the stope and increasing the pillar, without having to change in any way the level workings. Chutes are best spaced about seven meter centres, and it has been found by experience that fifty meter differences in elevation between levels are most easily worked. Each stope has its crosscut immediately under it, and running parallel to it, i.e., across the width of the orebody.

In the beginning of operations no timber except chute sets and a slight amount of material for crossings and station sets is needed; but when stoping operations cease and caving begins, more timber is necessary to hold open the haulage drifts. As the whole success of caving depends on the superincumbent pressure that can be brought to bear on the unbroken pillars, it is necessary to secure weight as quickly and as evenly as possible, and that means heavy ground on the haulage ways. These ways then have to be timbered, relieved, caught up, angle braced and kept in repair.

The process of caving consists of cutting off the pillar at the footwall and hangingwall by means of small stopes, or by running raises in which great blasts are exploded, either electrically or with fuse, and then by running a pillar drift along the bottom of the pillar immediately above the level, and blasting a series of pits here, the pillar is completely cut off and has to fail. If by any chance it tends to arch, this arch is broken by a heavy blast. The material resulting from the chute blasting is pulled out, and the pillar caves down to occupy the space left.

The most important consideration is the securing of even weight, and then as even pulling so that the extraction is not spoiled by waste admixture. Definite data are kept on every chute; its expectancy above the level figured, and its extraction checked when [illegible] definitely appears. Careful chute sampling is done on the caving level, and chutes running below commercial grade are abandoned unless it is known that the chute has ore above it. In case there is known ore above, and the waste is merely a little fine material that has sifted through, the chute is run, the material sent to waste and samples taken until it runs ore again.

Active caving is taking place on the Fortuna Nos. 2, 2½ and 3 levels and in the small orebody on the Fortuna No. 4 level known as the Bornite, caving has been fully completed, and the full percentage of the estimated tonnage has been conveyed. Fortuna No. 4 and Fortuna No. 5 are at present essentially haulage levels, to transport the tonnage from above to the point out to the mill. Fortuna No. 4½ is now opening up a continuation in depth of the Eureka orebody below Fortuna No. 4, and on the Fortuna No. 5 level advance headings are being driven under both Fortuna and Teniente sides of the centre to prepare for increased operations.

LAKELSE VALLEY AND HOT SPRINGS

In a lengthy report on Skeena mining division, in British Columbia, Mr. W. M. Brewer, of Victoria, gives much interesting information concerning many mineral claims and other mining properties he visited. The following excerpt relates to some hot springs in the Skeena country, and the region in which they occur:

Lakelse river flows from Lakelse lake northwesterly into Skeena river, which it enters at about 83 miles from Prince Rupert, and 12 miles below the Grand Trunk Pacific railway station at Terrace. Lakelse valley also includes the valleys formed at the mouths of Eliza and William creeks which empty into Lakelse lake at its head.

The valley in places is four or five miles wide and forms really the southeastern extension of the wide depression, which extends from Ayansh, on Nass river, to tidewater at the head of Kitimat arm, with quite low summits between Nass and Skeena rivers and tidewater. Looking from the summits of the mountain range at the head of Eliza creek, a full view of this magnificent valley can be obtained, stretching from northwesterly to southeasterly farther than can be seen with the aid of a powerful field glass.

Lakelse valley is bounded on the northeast by a high range of mountains known as the Thornhill mountains, in which head Eliza and William creeks with their tributaries. This mountain range forms a portion of the watershed of Zymoetz river, and is also the dividing line between Skeena and Omineca mining divisions.

Ferries across Skeena river have been built from both Copper City and Terrace, while good wagon roads extend up Lakelse valley to the south end of Lakelse lake, where the hot springs are situated, a distance of about 18 miles. These springs cover an area of about half an acre, and the water near the centre has a high temperature. The elevation is 300 ft. above sea level and 16.53 ft. above Lakelse lake. The springs were discovered in 1894 by M. C. Kendal, a prospector, while making a trip from Kitimat arm to Skeena river, but their existence was known to Indians at a much earlier period. Superstition is said to have caused the Indians to avoid the locality in early days, and to have marked a dividing line beyond which the Skeena River Indians never travelled to the southward, nor the Coast Indians to the northward.

The owners of the springs have erected a commodious log building for a hotel and bath house. The water is brought from the springs in an open wooden flume 1,200 ft. long, and during my visit the temperature of the water as it flowed into the bath reached 118 degrees Fahr. A sample of the water taken by me from [illegible] the spring as it was possible to reach analysed as follows: Total solids, 83 grains to the gallon, principally lime, with a little soda and magnesia in the form of chlorides and sulphates, but [illegible] sulphide or potash.

COPPER ADVANCES IN PRICE

[illegible] and orders in most recent months continue to occur in an [illegible] selling agency who are [illegible] to sell only for [illegible] months. One [illegible] sold not enough [illegible] [illegible] have entered the market in force, being [illegible] eagerly provided with the metal. [illegible] brass founders are taking [illegible] Foreign demand continues [illegible] and one [illegible] agency on November 20th [illegible] totalling 3,000,000 lbs. [illegible] metal to deliver.

GOLD DEPOSITS OF DUTCH GUIANA

By J. B. Percival.

Dutch Guiana offers at the present time grand opportunities for the investment of capital in the mining industry both alluvial and quartz undertakings. The gold placer mines are rich and only enterprise aided by the necessary capital is required to secure enormous profits. Gold is found in almost every part in the hinterland of the colony, from the Cerantyn river on the west to the Maroni or Maronyne on the east.

The annual returns from one placer alone for the last twenty years has been three hundred and fifty pounds troy weight. These returns have been produced entirely by hand labor and by the most primative methods of sluicing and "timming."

Most of the placers now operating have been worked for years by the natives and have all paid handsomely; many of the proprietors are to-day rich men and live in ease and comfort.

The mountains around these placers are marvels in richness, but they have never been touched by the pick or shovel, and only experienced miners in combination with up-to-date machinery is required to produce millions of dollars worth of the precious metal.

From the Cerantyn river on the west, which separates Dutch Guiana from Demerara, to the Marini river on the east, which in succession from the Tumae Humae mountain range to the Atlantic ocean from the boundary line between Dutch Guiana and Cayenne, the gold belt, which varies in width from fifty-five to one hundred and fifty miles, is thickly strewn with placers whose auriferous alluvial clay and gravel is rich beyond imagining.

In this country the mineral wealth is greater than all of the other products of the region combined, and the prediction is freely made by the most skilled experts that this country will form the theatre of one of the greatest gold excitements in the history of gold discovery.

Capital invested in the mining industry of Dutch Guiana is not only absolutely safe, but is almost certain to bring immense profits. Owing to the peculiar character of the region in which the gold placers are situated, and the strict nature of the governmental supervision, it is impossible for wild-cat schemes to prosper or for concessions to be made the basis of unwholesome speculation.

Under the just laws and regulations governing the mining privileges there is no opportunity for the practice of fraud or deception, a circumstance which is certain to invite capital and promote the development of the mining industry.

For a great many placers in Dutch Guiana the future prospects are bright. The richest spots in the placers which have been worked since 1878, do not seem to be exhausted, in fact they appear good for another forty years. The gold productions are satisfactory and many placers yield surprising quantities.

The annual production of the whole colony during the year ending with December 1st, 1914, was about $500,000, and all this was the outcome—as mentioned before—of hand labor.

Dutch Guiana may not be well known to Canadians generally, but they certainly are aware that South America is rich in gold-bearing quartz veins and it stands recorded where fabulous wealth has been taken out of mines in South America.

For instance, the El Calloa mine in Venezuela, the most famous in the world about forty years ago, is but a very short distance from Dutch Guiana. This was one of the richest quartz mines ever discovered. The mine was discovered by four Jamaica negroes forty-five years ago. This was not, however, an original discovery, for the mine had been worked years before by the Indians. Three of the negroes sold their interest to a party of Corsicans for a nominal price; the other, by good luck, held on to his fourth share. When the Corsicans discovered the great richness of the mine, they looked about for capital to work it. They sent two of their number to England who sold thirty-two shares at $2,000 per share. With the capital secured, $80,000 in all, they built a small stamp mill and put in the necessary machinery and began operations. In a short time the shares which had been purchased for $2,000 each, were worth $500,000, and the mine, originally worth $80,000, rose in value to the extent of millions. In a few years, however, the shareholders took out in clear profits something like $25,000,000. The monthly output of gold was 40,000 ounces

El Calloa was a quartz mine, and there are similar rich quartz mines running through Dutch Guiana. A recent discovery in the "Mindrinettee" district has just revealed a rich body of quartz averaging 16 feet in thickness, and traceable for about two miles along an east and west course. Developments have been carried out, and the vein proves everything that was expected of it, and every sign of improvement in values appear as sinking operations proceed. A small mill is kept running and handles twenty tons in twenty-four hours. The return of the last clean up after sixty hours' run was 28 pounds troy.

Origin of the Dutch Guiana Gold Deposits.—As far back as 1814 Le Blond, a French geologist, suspected the existence of gold-bearing quartz veins in the gneiss districts of French Guiana or Cayenne. These were later on discovered, but not until the end of the nineteenth century were they submitted to closer examination. Levat, a French mining engineer, was one of the first who endeavored to explain the presence of gold-bearing quartz in the Guianas. He looked upon the quartz as the result of contact phenomena, and according to him, the richest enclosed granite masses which occur in the gneiss formation. He asserted that the placers were richest in those spots where diabase and diorite rocks were found.

For instance, from the geology of the Saramacca placers, where large quantities of alluvial gold have been produced, it is quite evident that no granite masses occur, while diabase and diorite may be looked for in vain.

The district here described does not therefore bear out Levat's theory.

Many mining men—the writer included—are of opinion that the volcanic rocks of the colony contain the primary gold-bearing quartz, since gold has been repeatedly found in them in paying quantities. Professor Harrison, however, supposes that "The gold depositions follow the weakened or ruptured zones of certain pressure planes in the basic dykes, in their

contact with the older acidic rocks, or in common through both." According to Lungwitz's sketch on the Omai mine—British Guiana—it is probable that the above-named gold depositions are the secondary results of the quartz veins.

On the Saramacca placers gold quarts occurs in considerable quantities, notwithstanding that volcanic matter is about entirely absent.

F. C. Lincoln, in his article of 1911, showed that no placers of commercial value ever have produced from the primary contents of eroded igneous rocks.

This is also the case in Dutch Guiana, and the theory that the gold originates from those rocks can hardly be applied to the Saramacca district. Throughout the colony mining has been limited to the quartz veins only, and all the alluvial gold which have been examined, consist chiefly of quartz gravel, to which particles of gold still cling, mixed with sand and a little clay. All this points to the fact that the primary ores must be sought after in the quartz veins.

J. E. Spurr, in his theoretical survey of the genesis of gold ores in the colony comes to the conclusion that the quartz veins are the primary bearers of the gold, but that their existence in turn must be considered as the last phase of the volcanic movements of the sursoundings. The presence of basic and acidic volcanic rock could then still be a remnant of the above-named volcanic actions.

Volcanic rocks of any importance have been looked for in vain in the placers of the Saramacca. To the east of the concession, however, two small diabase veins crop out, and still further to the east diabase and diorite rocks crop out occasionally, but of gold there is no trace. To the westward of the placers there is a small quartz vein, containing a great quantity of tourmaline, but no gold. That there is some connection between the quartz veins and the eruptive rocks of the country remains possible, but that their mineral contents is the result thereof is highly improbable.

The latest valuable article dealing with the recorded occurrences of primary gold is from F. C. Lincoln. According to this paper, the facts lead to the following theory—quoting the resume in the "Mining Magazine," Vol. 5, No. 1:—"Gold has not been found in volcanic emanations and its presence in plutonic emanations has only been inferred. Gold has been found in the circulating waters of the earth's crust. There are a great number of valuable deposits of primary gold in geologically young conglomerates, several in geologically old conglomerates, and two known cases in metamorphic rocks, there is no gold in igneous rocks."

Lincoln suggests that "true" gold may be derived from older and very old buried placers by circulating waters, put in circulation by the intrusion of igneous rocks." So far as has been observed by me, this hypothesis cannot yet be considered for discussion in connection with the gold fields of Dutch Guiana.

In regarding separately the two different quartz vein groups, mentioned already, it is remarkable that the bedded veins occur everywhere, but the veins lying discordant in the gneiss formation are not so prevalent. In the vicinity of the Saramacca placers they seem to have concentrated in a particular zone, which follows the great Guiana fault, gradually less likely importance as the upheaval decreases or becomes more remote. From the hills to the east of Brokopondo, a small mining settlement on the Saramacca river—known as the White Water reef—also on the Saramacca placer—gold-bearing quartz veins are numerous, but are thickest near creek "Rose"—the richest spot on the Saramacca placer, that is, in the vicinity of the fault.

In the flats, to the south of the concession, thus in the sunken and bruised wing of the fault, several quartz veins may be found, but they do not contain gold.

Along the little Saramacca river, a tributary of the main river Saramacca, upwards, volcanic rocks occurs to some extent, but the district is remarkable for its lack of well known placers and thus of important gold-bearing quartz gravel formations. The known little Saramacca placers lie much lower down the river.

In another part of Dutch Guiana, on the Gray's concession at Brokopondo, on the Suriname river, there are high hills similar to those on the Saramacca placers. The creeks have cut themselves deep valleys, but in the gold-bearing formation very little gravel is found, and compared with the enormous quantity of washed away, weather-beaten and disintegrated rock masses, there is very little gold indeed. The cause must therefore be ascribed to the absence of great faults, whereby very few gold-bearing quartz veins have arisen and the alluvial formations have remained unimportant.

In the Maroni, or Maronyne district, the government instituted gold researches and the land was exploited. A map of surveying was made on which geological remarks were recorded. Granite masses, diabases, diorites, etc., were found, but no gold. Shortly after these exploitations came to an end, some native prospectors found gold in large quantities, in a district immediately south and not far from the government exploitation operations.

In some placers in Dutch Guiana quartz veins have no connection with volcanic rocks of granite-like structure, nor with those of porphyritic structure, or with lead silver veins.

Some deposits seem neither to contain talcomos or volcanic rocks containing gold-silver veins, as is the case with the gold of Cripple Creek ores, which has risen along irregular channels. The ores in many cases can neither be compared with those of sedimentary or apparently sedimentary origin. Thus, the gold-bearing quartz in some places in the colony cannot be entirely compared with the primary gold ores that have so far been found.

So far I have come to the following conclusions:

The existence of gold ore in some districts must be ascribed to the quartz veins which lie discordantly in the gneiss formation. The quartz veins themselves may [illegible] be commercial, but it is evident that they are dependent from the great Guiana placer fault and the less visible faults of the bruised wings.

The gold deposits therefore are not the direct result of volcanic action, nor of the extreme weatherworn condition of the gneiss formation and its contents, but of the more or less important neighboring faults principally.

A few authors are of opinion that the gold gravel formation was the source of the primary gold ores, whilst they pronounced the gold quartz veins to be secondary gold infiltrations from the gravel banks.

I am inclined to accept the possibility of similar petty infiltrations, but I have no faith in the supposition that powerful gold quartz veins at a height of 300 or more feet are infiltrated by the gold of gravel [illegible] from the valleys.

PERSONAL AND GENERAL

Dr. S. J. Schofield has been appointed professor of mineralogy and geology at University of British Columbia.

Mr. Geo. Church of South Porcupine, formerly chief engineer at Dome mine, expects to leave shortly for Juneau, Alaska.

Mr. Kirby Thomas has been examining properties in the Elk Lake district, Ontario.

Mr. Geo. Mackenzie of the Mines Department has been appointed a member of a commission to enquire into the supply of raw material for munitions.

Mr. J. G. McMillan, formerly mine inspector in the Timiskaming district, Ontario, is in Toronto recruiting for the Tunneling company.

Mr. A. C. Bailey is mine superintendent at the Mercer mine, Cobalt.

Prof. H. E. T. Haultain was in Ottawa last week.

Mr. Geo. T. Holloway addressed the Royal Canadian Institute at Toronto on Nov. 20, on "The Relation of the Chemical and Metallurgical Industries."

Col. Thos. Cantley is chairman of the new commission on supply of raw materials for munition manufacture.

Mr. George G. Aitken, of Victoria, B.C., who since leaving the Geological Survey of Canada has done most efficient work as Chief Geographer for the Province of British Columbia, recently resigned the latter position and came East for the purpose of spending several months at the Royal Military College, Kingston, and afterwards proceeding to Europe on active service.

Mr. Chas. A Banks, general manager for the Jewel-Denero Mines, Ltd., with a gold mine and 15-stamp mill in Greenwood mining division of British Columbia, has gone to England, to discuss future operations with the directors of the company. It is probable that he will make arrangements for service for some time in connection with the war in Europe.

Mr. W. J. Barker, of Nelson, B.C., after having for the greater part of the current year acted as superintendent of the Jewel gold mine, near Greenwood, B.C., during the illness of Mr. Wm. Rowe, is now in charge of development work at the Buck mining property, in the neighborhood of the Standard mine, Silverton camp, Slocan district of British Columbia.

Mr. Ed. E. Campbell has been placed in charge of mining operations at the Granby Consolidated Co.'s mines near Anyox, Observatory inlet, B.C. For some time previously Mr. Campbell had been the company's mining superintendent in the Valdez district, Alaska.

Mr. E. D. Conway, of Vancouver, B.C., one of the Granby Consolidated Co.'s field engineers, recently went to see a mining property near Nighthawk, northern Washington.

Lieutenant Graham Cruickshank, formerly in charge of the Consolidated Mining and Smelting Co.'s test concentrating plant at Rossland, left British Columbia about the middle of November with the 54th (Kootenay) Regiment for Eastern Canada to be in readiness to embark for England shortly.

Mr. Ensor R. Dunsford, Quarry, N.S., assistant superintendent for the Victoria Gypsum Mining and Manufacturing Co., Ltd., and Mr. Oliver Hall, Coniston, Ontario, mines superintendent for the Mond Nickel Co., have been proposed for membership in the American Institute of Mining Engineers. Several months ago Mr. Ben Gabriel Slaughter, Copper Cliff, chief engineer for the Canadian Copper Co., became a member of that institution.

Mr. F. W. Guernsey is again with the Consolidated Mining and Smelting Co., at Trail, having several months ago returned to British Columbia from Thompson, Nevada, where he was with the Mason Valley Co.

Mr. H. W. Heidman, of Vancouver, B.C., has been spending some time looking into mining conditions in the district about Princeton, Similkameen, B.C.

Capt. Harry Johns, of the firm of Keffer & Johns, Spokane, Wash., recently made a trip to San Francisco, California, where he visited the Panama-Pacific International Exposition. Mr. Frederic Keffer has been making an investigation into the situation at the British Columbia Portland Cement Co.'s properties in Similkameen district of British Columbia for the bondholders of the company, which is in liquidation.

Mr. Ernest Levy, manager of the Le Roi No. 2 company's mines at Rossland, was in Boundary district of British Columbia last month in company with Mr. W. Yolen Williams, who in earlier years was the Granby Consolidated Co.'s mine superintendent in that district. Since then Mr. Levy has been on a business visit to Spokane, Washington.

Mr. Anthony J. McMillan, under an arrangement with Government of British Columbia, is to deliver a series of addresses or lectures on that province before Old Country audiences. Sir Richard McBride has directed that a number of representative lantern slide views be sent to England for Mr. McMillan's use in that connection.

Mr. I. L. Merrill, president of the Hedley Gold Mining Co., reached Hedley, B.C., on November 11th on one of his periodical visits to the company's gold mine and 40-stamp mill in that camp. From Hedley he was to go to Victoria and thence to his home at Los Angeles, California.

Mr. J. F. Miller, superintendent of the Consolidated Mining and Smelting Co.'s electrolytic lead refinery, has returned to Trail from San Francisco, California. During his absence Mr. Miller was seriously ill for a while, but is now in better health.

Mr. Bruce R. Warden, for a number of years having his headquarters in Vancouver, B.C., is now on the engineering staff of the Consolidated Mining and Smelting Co. at Trail, where the company is making large and important additions to its already extensive metal-reduction plant.

Russell G. Bilden, of Spokane, Washington, a mining company promoter who eighteen years ago was convicted for using the United States mails for purposes of fraud in connection with the promotion of some companies which he alleged would acquire and operate coal-mining property in the Crowsnest district, near the boundary between British Columbia and Alberta, was taken last month to the prison at McNeil's island to serve a 12 months' sentence after having unsuccessfully fought a long legal battle to obtain a reversal of the decision that sentenced him to imprisonment.

SPECIAL CORRESPONDENCE

COBALT, GOWGANDA and SOUTH LORRAIN

New Discoveries.—Since silver has passed the danger mark of 50 cents and there appears every likelihood that it will advance with comparative rapidity many mines have resumed development and exploration. The result is almost immediate. There have been several strikes of new orebodies on Cobalt properties and some of them are quite important. This applies most to the discovery on the Cobalt Comet property at Kerr Lake.

The Cobalt Comet is one of the oldest mines in the district since the Drummond was the first mine to be worked in the Kerr Lake section of the silver camp. The Kerr Lake purchased 837,400 shares of Caribou Cobalt Mines stock in July, thus giving them a full control in this million share company. There is a knoll on this property which has always escaped exploration both on the surface and underground. This is most remarkable since it is of conglomerate, but most of the buildings were upon this hill and each succeeding management believed that it was quite useless to look in this direction. Since the Kerr Lake took hold of the property Mr. Livermore has been trenching this conglomerate section. Between the office and the manager's house there was discovered in a trench an eight-inch vein of niccolite and smaltite. The ore is massive and carries between three and four hundred ounces to the ton. It has now been opened up for several feet northeast of the discovery, upon which a shaft is being sunk. Several shoots of high grade ore have been discovered. This ore, which is three or four inches wide, is very rich indeed. Where the vein was discovered there was much cobalt bloom and in the decomposed matter above the solid vein there have been found indications of silver and the earth pans much leaf silver. The shaft is being sunk at the point where the vein is strongest. Ninety feet below and about forty feet away from the point where the vein was good there was a drift. This drift is being continued for the purpose of making connections with the new shaft. Although at this time of writing it is far too early to venture on any propheey as to the real value of this discovery, even now it can be said with certainty that it will yield a considerable quantity of mill rock and it may produce a good deal of high grade ore. Exploration in other directions is being vigorously prosecuted from the Kerr Lake Mining Co. The mine is the Drummond which up to [illegible] ed out by the original owners four or five years ago. Another manager recognized its possibilities in low grade ore and took from it a very large tonnage. It is quite possible that the Kerr Lake may extend the life of the mine for years. It is an admirable example of the tenacity to life shown by Cobalt mines.

Mercer.—Another discovery of less apparent importance is that made on the Mercer Silver mines within the past week. Here a two-inch vein of high grade ore has been discovered in a raise from the 200-ft. level. The Mercer Silver Mines is a company formed to take over the old Gould lease on Cart lake. They sunk a shaft on the east side of the lake in virgin territory. This is the first result from the work.

The Nipissing Mining Co. has decided to develop the ore deposit on the Cobalt Lake fault from a shaft on an adjoining property. This shaft will be sunk 250 ft. before any crosscutting is attempted. It is a shaft belonging to the Cobalt Lake Mining Co. and from the orebody can be cut with very little dead work. While it is known that the ore does dip on to the Nipissing nothing can be said yet as to the width or value of the ore on the Nipissing side of the line. It is anticipated, however, that it should be a valuable addition to Nipissing ore reserves.

The Timiskaming Mining Co. has declared an interim dividend of three per cent. This dividend will amount to $75,000 and it is certain that the company is quite well able to make it. The mine is in excellent shape and there is a large amount of ore broken and ready for stoping in the mine.

Foster.—From the Foster mine there has just been shipped three tons of high grade found near the Lawson line. It was sent to Campbell & Deyell's for sampling, and will probably be sold to a local reduction company.

The Silver Leaf has shipped four or five tons of high grade ore.

PORCUPINE, KIRKLAND LAKE and MUNRO

Buffalo.—There is going to be a very busy winter in Kirkland Lake. The Buffalo Mining Co. has completed the building to house their 100-ton mill. It will be roofed in before this is in print. The flow sheet has been completed and the machinery ordered. Work will probably be started underground within a very few days.

The Beaver Consolidated has definitely taken over the McKane claims from the Kirkland Gold Mines. There is no doubt that the Cobalt company will put forth a vigorous policy of development. There will be no delay due to construction of plant as there is a very complete prospecting plant adequate for operations on a small scale.

At Swastika Mr. F. L. Culver is running drills in the old Swastika mine to endeavor to discover further orebodies or extensions of old orebodies. This mine produced $60,000 in gold before it shut down. There is [illegible]

In Goodfish Lake the La Belle Teck Mining Co. has almost completed the assembling of the small steam plant. On the surface exploration has been quite satisfactory which is demonstrated on length and value of the orebody on the fissure where the ore was de[illegible] found in a drift on the Costella. This is on the other side of Goodfish lake.

At Kirkland Lake the Lake Shore mine has resumed operations. Two drills are putting down the shaft to the 400 ft. level. From this shaft levels will be continued to the east where, in the old workings, have proved most valuable.

Hollinger.—During the past months some important developments have been made at the Hollinger mine. The ore encountered from the 425-ft. level has come within a comparatively short distance of the surface. These ore bodies are four feet and ten feet wide and carry ten to eleven dollars a ton in gold content.

Millerton.—On the Millerton claim of the Hollinger [illegible] veloped more satisfactorily than was anticipated by the management. The ore is proving almost [illegible] a ton, otherwise on the surface it did not exceed [illegible] be eight dollars. It has been encountered [illegible] least seven feet wide and the ore of remarkable [illegible]

not reached in the cross-cuts. Surface improvements are keeping pace with this development underground.

The new wing to the Hollinger mill is making satisfactory progress and Mr. Ames, the new superintendent, is effecting various economies which will bring costs down to considerably less than a dollar a ton as a milling charge.

The new office building is a very handsome one and the shell of it will soon be completed. Still quicker progress has been made with the directors' bungalow.

The masonry of the great new shaft on Hollinger hill has been completed and the contract for the head frame has been let to the Dominion Bridge Co. This contract calls for the completion of the head frame by the middle of December. The freight cars are now running right into the heart of the Hollinger property instead of all supplies being teamed from the town siding some half mile from the mine. All supplies are unloaded from the cars on to a track on a six-ton locomotive and lines have been laid to all centres of activity in the mine. A considerable saving in transportation will thus be effected. The transformer house was also found to be too small for the rapidly growing requirements of the property and the foundation of a new building has been laid between the old office and the mill.

Silver at Porcupine.—It has always been remarked that while silver is usually present in the auriferous ores of Kirkland Lake and Porcupine there is never enough to be considered as anything but a by-product of very minor importance. Several discoveries have recently been made which may alter the relative value of silver in areas where gold is the chief attraction. The claims of the Premier Langmuir were staked for silver in the early days of the Porcupine camp. Silver is now being found to pay the cost of freight on the barite ore which is being shipped to the States. On the surface there is native silver in this ore, but later it did not appear and the barite is now being mined as an adulterate of white lead. The other discovery is in the Kirkland Lake section about four and a half miles from the Tough-Oakes. It is as yet but a prospect of dubious value. The native silver is to be plainly seen in the ore, which is mainly galena. The vein is two feet wide. It is said to run fairly well in gold too.

Munro.—The development work upon properties in Munro township, other than the Croesus Gold Mines, has almost been stopped by the wet weather. The eleven miles of road between Matheson and Munro has been little better than mud, and it was not possible to get wagons loaded to full capacity, over them. The Croesus Gold Mines is the company name of the old Leyson-Dobie claims the Dominion Reduction Co. took over and found such remarkable ore in.

SUDBURY

Creighton.—Great activity has been shown at Creighton mine during the past four or five months, in which time not only have additions been made to the plant itself but also to the town. In the town there have been constructed two brick blocks. One is finished and another nearing completion. A brick school has been finished, also a theatre of brick construction and a church. In addition about forty or fifty dwellings have been moved from the Frood mine and many new houses have been built both by the company and individuals.

To the plant itself new shops, a new power house, rock house and head frame are all nearing completion. The shops embrace a warehouse 200 x 48, with a covered shed at each end and an unloading platform with spur connection to the railroad. Another building of the same size will be used as a machine and electrical shop. A third building will be the carpenter shop. All these buildings are of steel and brick construction and the warehouse has a concrete floor, while the others have wooden floors. These shops are very nearly completed.

Creighton Rock House.—The concrete work on the rock house is about finished and steel workers will soon take possession. This will be a tall building, being about 170 ft. high. Various tests have been made on sizing of the ore and the use of water for sorting purposes. Different types of lighting are also being experimented with and the rock house when completed will be one of the most modern in existence.

The shaft house in addition to the skip room and various offices, will have a room for the men to use while waiting for the cage. Thus it will not be necessary for them to remain exposed to the weather while waiting to descend into the mine, at which time they are clad very lightly.

Creighton Shaft.—These new head workings are in connection with a new five-compartment shaft that is being sunk. It is inclined at 55 degrees. There are two skipways, two cage compartments and a ladder and pipe way. Only a temporary hoist is in use now and the permanent machine will be one of the largest in the country. This will make the fifth hoist at Creighton. There is at present a two-drum hoist at No. 2 shaft, a single drum hoist at No. 1 shaft provided with two brakes for handling the man cage, a two-drum hoist for handling the two five-ton skips which are used in balance, and an auxiliary two-drum hoist in case of accident to the one in use.

A new powder magazine is also being constructed on the Creighton property. It will be located on a hill at some distance from the town and mine workings and a tunnel into the mountain will afford access to it. A track will connect the magazine by means of the tunnel with a siding.

Frood mine of the Canadian Copper Co. was closed down when the large new orebody at Creighton was found. Most of the machinery and practically all the dwellings have been taken to Creighton, but the camps with the heating plant still remain. The company has very generously offered the use of these buildings to the Government for the purpose of housing recruits for the winter. They will also provide a man to look after the heating apparatus. These buildings will make excellent barracks and the idea has gained great favor in Sudbury, as it will mean much increased business for the town in every way. It is thought quite probable that the Government will take advantage of the offer.

Moose Mountains, Ltd., located at Sellwood, has closed down. The method of treating the ore has proved unsuccessful and until further experiments have been made no more work will be done. All the men have left and things are closed up tight.

A novelty in tank construction is to be seen at Creighton mines, where an iron tank has been circumscribed with a brick wall. Between the tank proper and the wall an air space has been left in which electric heaters will be placed, so as to protect the tank against the wintry weather and insure a winter supply of water. The tank is on a high hill, insuring a great pressure. It is 40 by 25 ft

Shining Tree.—The Canadian Copper Co.'s option on a Shining Tree copper property is reported to have been given up. The property is supposed to have run about 1½ per cent. copper and to have a gold content. The difficulty of access to the property and the expenditure necessary to start the work is the big argument against the prospect. Another company now has the option under consideration.

BRITISH COLUMBIA

Whether warranted by actual achievements of the year now drawing to a close or not, there certainly is a better feeling in connection with the mining industry of the Province than existed early in the year, and most assuredly a transformation from the doubts and fears that a year ago were general in mining districts affected by the practical closing of the market for the metals constituting the larger part of the metalliferous mineral production of British Columbia. In the autumn of 1914 many of the mines were inoperative, especially in Ainsworth, Slocan and Boundary districts; now there are few of those idle that were then for the time being adversely affected by the outbreak of war in Europe. This much improved situation causes optimism and fosters confidence, with the result that money is again available for the development of mining properties, and the mining industry is benefited accordingly.

West Kootenay.

Of all the mining camps in this district, Rossland camp, in Trail Creek mining division, gives the most evidence of substantial progress. Last month figures were supplied indicating an expected increase in total quantity of ore shipped this year to the smeltery at Trail of about 52,000 tons. The most gratifying feature of the situation at Rossland is that there is good reason to look for permanence in mining operations, at least for a generation, since the known ore reserves are large and the average value of the ore is sufficiently high to make its mining and smelting profitable.

At Trail, the smelting centre for Kootenay ores, important progress is more manifest, since there it is on the surface, while in Rossland camp it is chiefly underground. Of course the greatest activity is at the Consolidated Co.'s smelting and refining works, where many improvements and additions have been made during several recent years. In fact, there has been an almost entire transformation of the ore-reduction side of the works, old buildings and plant having been gradually replaced by larger modern structures and equipment, thus providing for a considerably increased ore-treatment capacity and this at reduced cost. These comments apply to both lead and copper smelting departments. Larger storage bins for ores with ample provision for bedding so as to secure generally uniform charges for the blast furnaces, enlarged and improved sample mills, better transportation arrangements between ore beds and furnaces, bigger blast furnaces for both copper and lead, an overhead electrically-operated crane for handling matte pots, the substitution of Wedge roasters for the old Huntington Heberlein roasters long in use in the lead department, belt-conveyors for handling materials in and from the roasters, several reactors of the Cottrell system for precipitating metals carried from the furnaces in the fumes and smoke, and many other provisions for more expeditious and economical treatment of ores and furnace products and, as well, for improving working conditions for the men employed in the smeltery. Methods at the company's electrolytic lead refinery are also up to date. Excellent progress has been made toward the completion of installation of copper-converting plant and it is generally understood (though not so stated by the local officials) that it will not be long before copper refining by the electrolytic process will be undertaken here. Meanwhile the buildings and machinery for zinc reduction works being erected and installed by the company are an earnest of the intentions to also make spelter at Trail, though no information is being given out relative to this further extension of the company's activities.

Similkameen.

The production of lode gold is being maintained at about the usual rate at the Hedley Gold Mining Co.'s mine and stamp mill in Camp Hedley. The additions made during the current year to the company's gold milling appliances, following the completion of its hydro-electric power system, allow of a somewhat larger percentage of the gold in the ore being saved, and with ore reserves known to be large, the outlook for continued profitable operation of the property is regarded as most satisfactory.

At Princeton, the coal mining situation shows improvement, largely the result of the opening of more markets now that there has been established a railway train service southeast to the Okanagan district and northwest to the C.P.R., thus giving a much shorter connection with Vancouver and other places on the Pacific coast than is afforded by the Great Northern system southeast to Spokane, Washington, and thence by a long and roundabout route to Vancouver. The saving in freight charges is evident when a comparison of railway mileage between Princeton and Vancouver is made. From Princeton to Vancouver via Spokane and Great Northern railway, is 735 miles; by the Kettle Valley and Canadian Pacific railways it is 285 miles. Princeton coal, therefore, can now be sent to Vancouver by a route 450 miles shorter than it had to travel to reach that city before the opening of the Kettle Valley railway to connect with the Canadian Pacific system. Then, too, the railway connection with Okanagan and Boundary district towns not previously accessible by railway, except in some cases by most circuitous routes, is another advantage. Together these additional railway facilities are providing outlets for Princeton coal that are admitting of the gradual building up of a regular coal trade and the consequent working of the Princeton Coal and Land Co.'s coal mine without the interruptions that have heretofore necessitated its operations being intermittent.

ence of the Tulameen and Similkameen rivers. It is stated that there has been more placer mining done on the Tulameen this year than for a number of years past, the high price of platinum having proved an incentive to miners to work their placer leases this year. While the total value of the placer gold and platinum recovered this year is not large, so far as known it is higher than the total of any two or three-year period as recorded, probably during the present century. On Granite creek, too, placer mining has been carried on this year, and a fair amount of gold has been recovered, though not so much as was expected, several unforeseen difficulties having prevented the washing of the much larger quantity of gravel that it was estimated earlier would be run through the sluices this year. However, it is the intention of those who have done the most work to do what they shall find practicable throughout the winter to prepare for washing a larger quantity of gravel next year.

General Notes.

In connection with published figures purporting to show the amounts paid as dividends this year by metalliferous mining companies operating in British Columbia—a total given for the Le Roi No. 2, Ltd., is entirely erroneous. It has been made to appear that this company this year has paid two dividends, each totaling $150,000; as a matter of fact, when that misstatement was given publicity the company had paid only one dividend in 1915, and that of one shilling a share on its 120,000 shares, the total for that profit-distribution having been less than $30,000. It was expected that a second similar dividend would be paid before the close of the current year, but at the time the misinformation was given to the public by one unreliable writer, and copied by others equally ill-informed, the stated total payment this year of $300,000 was more than ten times the amount of that actually distributed.

A report has been received of a find of ore in the district lying between the Nicola Valley region and the northern part of the Similkameen country. Specimens shown are of solid copper-bearing ore that looks promising for a fairly high copper yield, but no authentic particulars are available as to the extent of the ore deposit, so far as opened, nor as to its assay value. It is known, though, that copper ore occurs in considerable quantity in the neighborhood of the locality in which the new find has been made, but, owing to lack of transportation facilities, it has not been developed.

A Vancouver newspaper lately published an account of progress reported to have been made on the Surf Inlet Gold Mines property, on Princess Royal island, in the Coast district north of Vancouver. For several years development work had been done on this property by a Vancouver syndicate or company until about two years ago it was brought to the attention of the Tonopah-Belmont company, operating in Nevada, and since bonding the property the latter company has done much work on it. The statement now made is to the effect that a fine shoot of gold-bearing ore has been encountered at a depth of approximately 1,000 ft. below the outcrop at the surface. Whatever the facts of the case—and published reports should not for the present without verification be taken as accurate statements of the actual position, since it is not the policy of the Tonopah-Belmont Co. to give out much information—there is no doubt that good reason has long existed, for the belief that eventually the Surf Inlet property would be found fully equal to expectations founded on the excellent reports made by mining engineers of good standing and on the results of the limited amount of development work its Vancouver owners had found it practicable to do.

Little information has been made public this year relative to the Iron Mask mine, situated a few miles from Kamloops, but it is evident that progress is being made at it, since the total quantity of ore received at the Consolidated Mining and Smelting Co.'s smelting works at Trail from the Iron Mask group between July 1st and November 4th of the current half year was 1,019 tons, which quantity compared with 289 tons for the whole of the year 1914. The Gold Commissioner for Kamloops mining division was quoted in the 1914 Annual Report of the Minister of Mines for British Columbia, as follows: "There has been little mining activity in the Kamloops division, but faith in the future has been shown by the keeping-up of assessment work generally, and by the owners of the Iron Mask mine in the expenditure of a considerable amount of money in preparing for future development. . . . E. C. Wallinder (managing director) reports that the shaft on the Erin claim was sunk to a depth of 330 ft. The Iron Mask shaft was sunk 150 ft. to the 750-ft. level, where drifting and cross-cutting are now in progress. The mill has been enlarged to 750 tons capacity; machine and carpenter shop erected; 500,000-gal. tank for water storage and fire protection constructed; and a 750-h.p. electrical equipment completed." The property was visited by Mr. W. M. Brewer, on behalf of the Provincial Department of Mines, and his account of it was published, probably in the 1913 Annual Report, but as these notes are being written on train in another part of the country, no additional particulars of the Iron Mask property can be given here at this time.

NEWFOUNDLAND

Iron Ore.—As the season advances, and winter draws nigh, the shipments of iron ore from the iron mines of Bell Island are more frequent and the cargoes if anything larger than those shipped in the summer months. The cause for this is that by the end of the present months, the boats chartered by the Dominion Iron & Steel Co. and the Nova Scotia Steel & Coal Co. finish their charters for this year, in connection with the iron ore trade of Newfoundland, and take up work in southern waters during the winter months. The shipping season, now about closing, was the most successful in the history of these mines. Work will be carried on during the winter months with renewed activity, employing in the neighborhood of 3,000 men working full time day and night, so that by the time navigation opens in early spring large stocks of ore will be all ready for shipping.

In addition to the large army of men these companies will employ during the winter season at Bell Island workings, they are also sending forward by every available opportunity large numbers of men to their operations at Sydney, C.B. These will be employed at various works, some around the smelting works, but the greater number, it is understood, will be employed at the coal mines.

Since the outbreak of the war in August, 1914, the importation of coal from Sydney and Wales to this country, has nearly doubled that of preceding years. This was brought about by the increase of steamship cargoes going from here, and because of several ships coaling here during the past year. In addition to this some forty steamers took cargoes of pit-wood from dif-

ferent ports of Newfoundland to England the past season and many of these ships took on supplies of coal from St. John's.

Copper.—Work on the copper mines of Tilt Cove and Baie Verte are progressing favorably with the usual shipments to the English and American markets. Both mines will carry on operations all through the winter months and the copper will be piled ready for shipping in the spring. Cargoes will be sent forward as long as navigation will permit this year.

Few Accidents.—All the mines in operation the past year have been most successful in the matter of any serious accidents. Not a person wounded or killed in the copper mines. One miner was killed and another wounded by a fall of ore in one of the workings at Bell Island at the beginning of this month. That this was the only serious mishap speaks well for the efficiency of our miners and for the careful supervision of the work carried on.

Porte-de-Grave.—A meeting of the directors of the Porte-de-Grave Mining Syndicate, Limited, was held last week at its offices on Water street. The syndicate intends to carry on work until next spring, when it is said the property changes ownership, being sold to one of the largest steel companies in the United States, for a very handsome figure.

Oil Shale.—Development of the great oil shale deposits owned by the Colonial Oil, Shale and Chemical Company has been considerably delayed owing to financial matters arising out of the war. The property was thoroughly tested and the engineers report very large deposits of shale, some of which gave as high as 47 gallons of oil to the ton, with very valuable by-products. But for the outbreak of the war it is not unlikely that ere this the company owning the property would have established a plant. Some men are kept working on the property and the company still continues to make tests of the shale from different parts of the deposit. All samples are being shipped to London and are tested in a miniature plant which has been erected solely for this purpose.

Limestone Quarries.—Work on the limestone quarries at Port-au-Port, owned by the Dominion Iron & Steel Company which were not in operation the past season, will be reopened on the return of spring. The limestone from these quarries is used in large quantities as a flux in connection with the smelting works at Sydney, C.B.

Newfoundland Products Co.—The survey of the Humber River Valley, and other different sections of the properties acquired by the Newfoundland Products Company is progressing favorably under a large and competent staff of engineers. It is thought the company will make a start next season to do some mining work on its marble quarries at Pierre's Brook, and other areas, although it must take all of three years to build, equip and establish such a mammoth plant as this company contemplates, which will cost in the aggregate eighteen million dollars.

A New Smelter.—At a meeting of the municipal board, held last week, Mr. W. A. MacKay was present and gave full explanation of the nature of the proposed smelter he intends to erect on the Reid Newfoundland Company's land west of Middle Cove. The plans were submitted and approved, and Mr. MacKay assured the board section of the building and installing of plant would be undertaken at once and finished with all possible speed. The plant will run full blast during the winter, and Mr. MacKay is very optimistic as to the future. The Reid Newfoundland Company will supply the necessary electric power for all smelting purposes.

DEPARTMENT OF MINES PUBLICATIONS.

Electrothermic Smelting of Iron Ores in Sweden—By Alfred Stansfield—Published by Mines Branch, Ottawa.

Mr. Stansfield visited Sweden during June and July, 1914, and inspected the principal smelting plants, to obtain information with regard to the operation of the electrothermic iron-smelting furnaces. The results of his investigation are given in this report, a copy of which can be procured by application to the Mines Branch.

Arisaig-Antigonish District, Nova Scotia—By M. Y. Williams—Memoir 60—Published by the Geological Survey, Ottawa.

The purposes of further examining this district were mainly to work out in greater detail the age relations of the rocks. The geology of the district was remapped. The economic mineral resources of the Arisaig-Antigonish district are neither of great variety nor have they proven so far of great commercial value. Most important are the iron-ore deposits which were first prospected many years ago. Next in importance are the gypsum deposits which as white cliffs form a noticeable landscape feature along the Intercolonial railway. Oil-shales have been found in limited quantities and signs of copper occur at a number of localities. Indications of silver have been previously reported, but no evidence of its presence has been recently found. Limestone, formerly quarried to some extent for the manufacture of quicklime, is present in considerable quantity, and stream gravels suitable for concrete work form local deposits along the streams.

Rainy River District, Ontario, Surficial Geology and Soils—By W. A. Johnston—Memoir 68—Published by Geological Survey, Ottawa.

The object of this report is to present the results of an investigation to determine the distribution and character of the different soils of the region and the geology of the various unconsolidated rocks of such deposits upon which the different soils have been developed.

Map of Upper White River District, Yukon Geology—By D. D. Cairnes—Topography by W. E. Lawson—Map 123A—Published by Geological Survey, Ottawa.

This is a geologically colored map of an area west of White River from Sheep Creek to the vicinity of Canyon City.

Notes on the Geology and Palaeontology of the Lower Saskatchewan River Valley—By E. M. Kindle—Museum Bulletin No. 21—Published by Geological Survey, Ottawa.

The observations recorded here are the result of field work undertaken during 1913 by the geological party of the Canada Department of Mines, and the geological

MARKETS

STOCK QUOTATIONS.

(Courtesy of J. P. Bickell & Co., Toronto.)

Nov. 26, 1915.

New York Curb.

	Bid.	Asked.
Braden Copper	16.62½	16.87½
Chino Copper	55.00	55.25
Goldfield Cons.	1.18¾	1.31¼
Granby	83.00	84.00
Inspiration Copper	46.00	46.25
Miami Copper	34.50	34.75
Ray Cons. Copper	25.75	26.00
Tonopah Mining	6.75	7.00
Tonopah Merger	.40	.45
Yukon Gold	2.75	3.00

Porcupine Stocks.

	Bid.	Asked.
Apex	.03	.03½
Dome Extension	.27	.27¾
Dome Consolidated	.20	.20½
Dome Lake	.20	.22
Dome Mines	28.00	28.25
Foley O'Brien	.50	.60
Hollinger	26.00	27.50
Jupiter	.13¾	.14½
McIntyre	.83	.84
McIntyre Extension	.30	.31
Moneta	.07½	.08
Plenaurum	.75	.90
Porcupine Vipond	.72	.73
Porcupine Imperial	.04¼	.04½
Porcupine Crown	.83	.85
Preston East Dome	.04½	.05
West Dome	.08⅝	.09

Cobalt Stock.

	Bid.	Asked.
Adanas	.25	.26
Beaver	.39	.40
Buffalo	.65	.80
Chambers Ferland	.30¾	.21
Coniagas	4.50	4.60
Crown Reserve	.65½	.66
Foster	.05	.06
Gifford	.02¾	.03
Great Northern	.03	.03½
Hargraves	.02	.03
Hudson Bay	20.00	22.00
Kerr Lake	4.20	4.40
La Rose	.75	.80
McKinley	.43	.45
Nipissing	7.45	7.60
Peterson Lake	.37½	.38
Right of Way	.05	.06
Rochester	.03½	.04
Teck Hughes	.11	.12
Temiskaming	.59	.60
Trethewey	.18	.19
Wettlaufer	.09	.10
Seneca Superior	.89	.90
York Ontario	.01½	.01¾

SILVER PRICES.

	New York. cents.	London. pence.
November—		
9	50⅛	24 7/16
10	50	24⅜
11	50¼	24 7/16
12	50¼	24 7/16
13	50¼	24 7/16
15	50⅜	24½
16	50⅝	24⅝
17	51	24¾
18	51⅜	24 13/16
19	51⅞	25
20	51½	24 7/8
22	52⅛	25⅛
23	52¾	25⅜
24	54½	26⅛

TORONTO MARKETS.

Nov. 26, 1915—(Quotations from Canada Metal Co., Toronto)

Spelter, 21 cents per lb.
Lead, 7 cents per lb.
Tin, 43 cents per lb.
Antimony, 48 cents per lb.
Copper casting, 20¾ cents per lb.
Electrolytic, 20¾ cents per lb.
Ignot brass, yellow 13c.; red, 15 cents per lb.

Nov. 26, 1915—(Quotations from Elias Rogers Co., Toronto)

Coal, anthracite, $7.75 per ton.
Coal, bituminous, $5.25 per ton.

NEW YORK MARKETS.

Nov. 24, 1915—Connellsville coke (f.o.b. ovens)—

Furnace coke, prompt, $2.15 to $2.25 per ton.
Foundry coke, prompt, $3.00 to $3.25 per ton.

Nov. 24, 1915—Tin, straits, 39.25 cents.
Copper, Prime Lake, 19.75 to 20.00 cents.
Electrolytic Copper, 19.62½ to 19.87½ cents.
Copper wire, 20.87½ to 21.12½ cents.
Lead, 5.25 cents.
Copper wire, 20.87½ to 21.12½ cents.
Sheet zinc (f.o.b. smelter), 22.00 cents
Aluminum, 56.00 to 58.00 cents.
Nickel, 45.00 to 50.00 cents.
Platinum, soft, per ounce, $68.00.
Platinum, hard, per ounce, $72.00.
Quicksilver, per 75-lb. flask, $105.00.
Cobalt (metallic), $1.25.

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

Ontario
Cohen, S. W.
Campbell & Deyell.
Carter, W. E. H.
Ferrier, W. F.
Forbes, D. L. H.
Gwillim, J. C.
Hassan, A. A.
Haultain, H. E. T.
Segsworth, Walter E.
Smith, Alex H.
Smith, Sydney.
Maurice W. Summerhayes.
Tyrrell, J. B.

Quebec
Burchell, Geo. B.
Cohen, S. W.
DePencier, H. P.
Hardman, J. E.
Hersey, Milton L.
Johnson, W. S.
Smith, W. H.

British Columbia
Brown & Butters.
Fowler, S. S.

FOREIGN-New York
Canadian Mining & Exploration Co., Ltd.
Colvocoresses, Geo. M.
Dorr, Jno. V.N.
Hassan, A. A.

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Consulting Mining Engineer
MONTREAL, CANADA

SPEARMAN CHAS., B.Sc., M A.
Mining Geologist and Engineer
Structural geology problems relating to ore deposits, examinations, reports, petrographical examinations, radio-active tests, etc. Box 413, Haileybury, Ont.

FERRIER, W. F.
Consulting Mining Engineer and Geologist
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HASSAN, A. A., COBALT, ONT.
Mining Geologist and Consulting Engineer.
15 BROAD ST., NEW YORK CITY, N.Y.
[illegible]

BURCHELL, GEO. B.
Mining Engineer
Lignite and Bituminous Coal Mining
Examinations and Reports
505 McGILL BLDG., MONTREAL
[illegible]

FOWLER, S. S.
Mining Engineer,
NELSON, B. C

JOHN V. N. DORR
[illegible]
17 Battery Place New York City
and
First National Bank Building
[illegible]

CANADIAN MINING AND EXPLORATION CO., LIMITED
WILLIAM WALLACE MEIN, Consulting Engineer
Mining Properties [illegible]
43 Exchange Place New York Cable [illegible] New York

FORBES, D. L. H.
Mining & Metallurgical Engineer
Chuquicamata, Chile
[illegible]

SMITH, SYDNEY.
Mining Engineer,
HAILEYBURY, ONT.

CARTER & SMITH
Consulting Mining Engineers
Hermant Building, 19 Wilton Ave.
TORONTO
W. E. H. Carter B.A. Sc. Alex H. Smith, M.I.M.M.

GUESS & HAULTAIN
Mining & Metallurgical Engineers
[illegible]

SUMMERHAYES, MAURICE W.
Mining Engineer,
Manager
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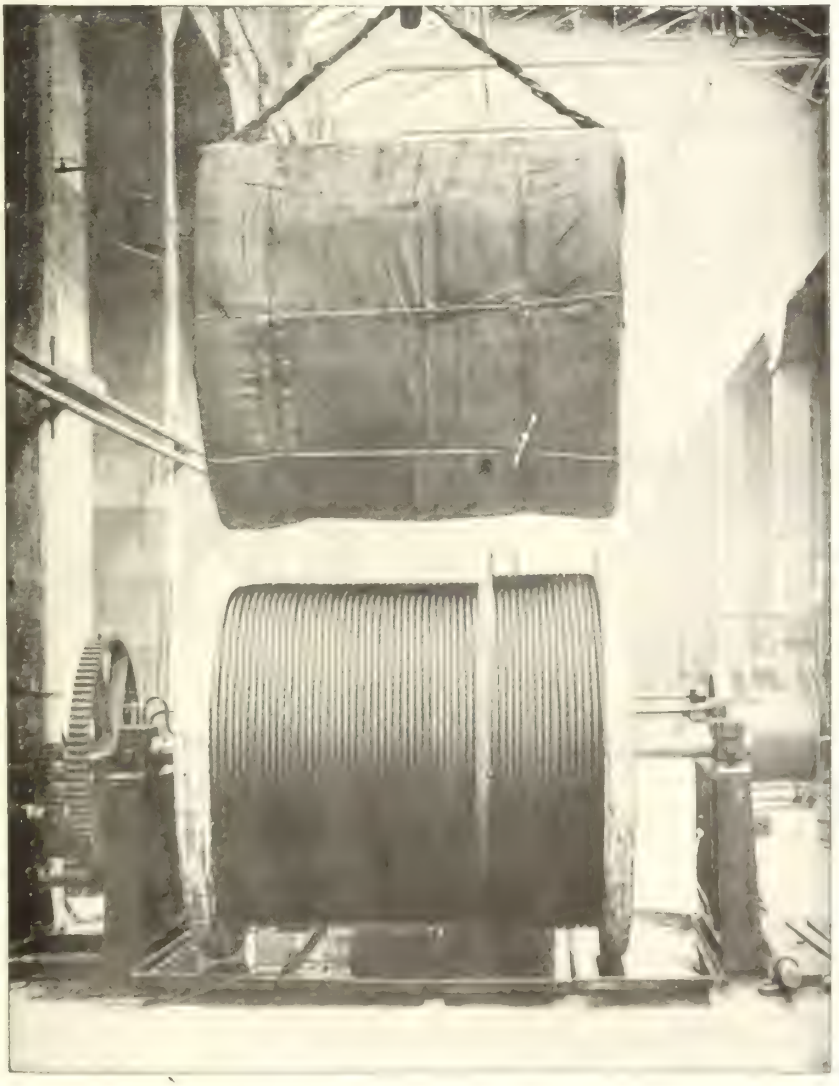

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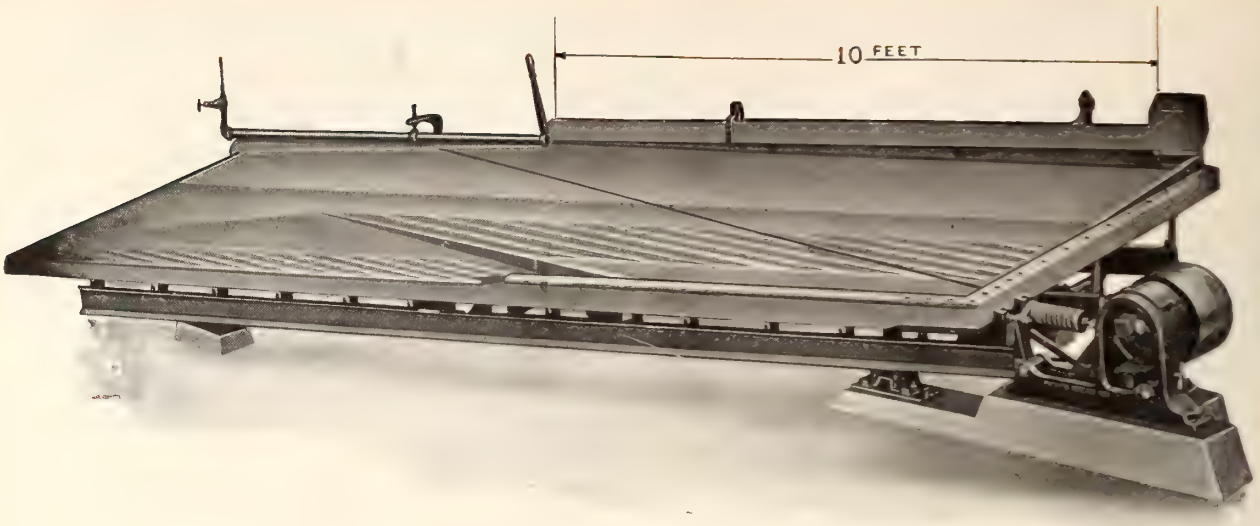

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VOL. XXXVI TORONTO No. 24

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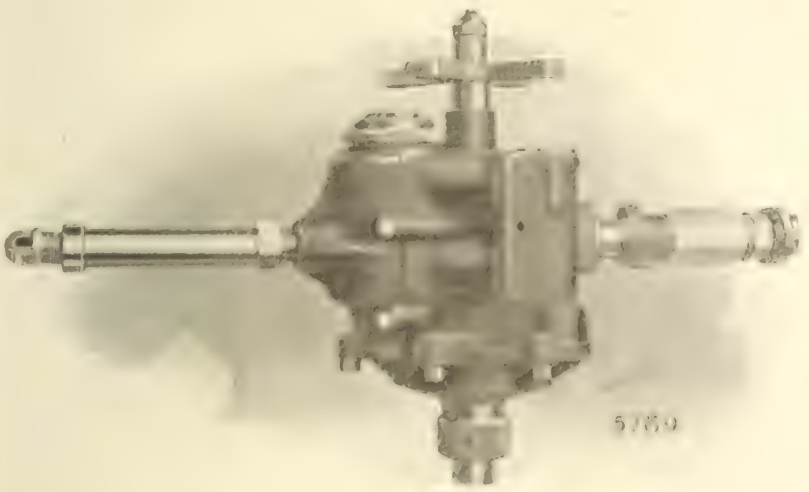

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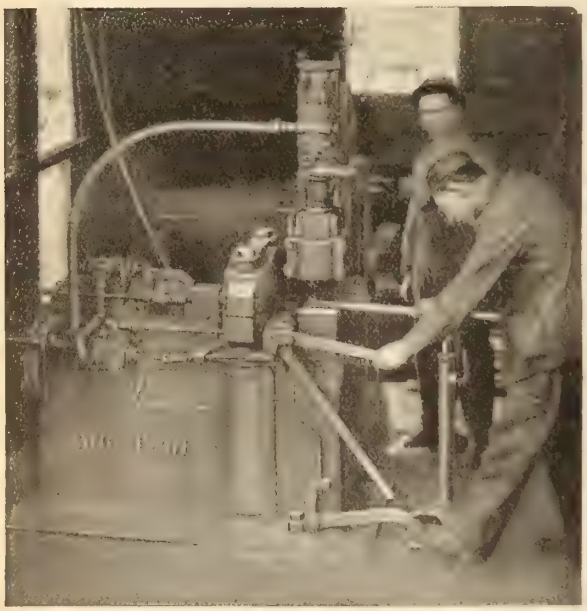

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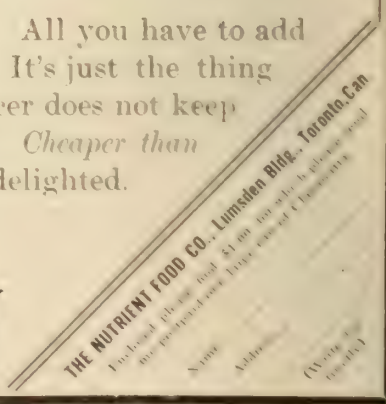

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Application for a lease must be made by the applicant in person to the Agent or Sub-Agent of the district in which the rights applied for are situated.

In surveyed territory the land must be described by sections, or legal sub-divisions of sections, and in unsurveyed territory the tract applied for shall be staked out by the applicant himself.

Each application must be accompanied by a fee of $5 which will be refunded if the rights applied for are not available, but not otherwise. A royalty shall be paid on the merchantable output of the mine at the rate of five cents per ton.

The person operating the mine shall furnish the Agent with sworn returns accounting for the full quantity of merchantable coal mined and pay the royalty thereon. If the coal mining rights are not being operated, such returns should be furnished at least once a year.

The lease will include the coal mining rights only, but the lessee may be permitted to purchase whatever available surface rights may be considered necessary for the working of the mine at the rate of $10.00 an acre.

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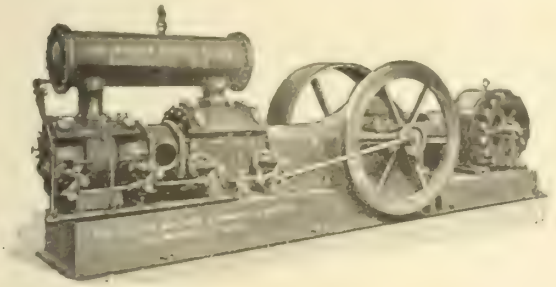

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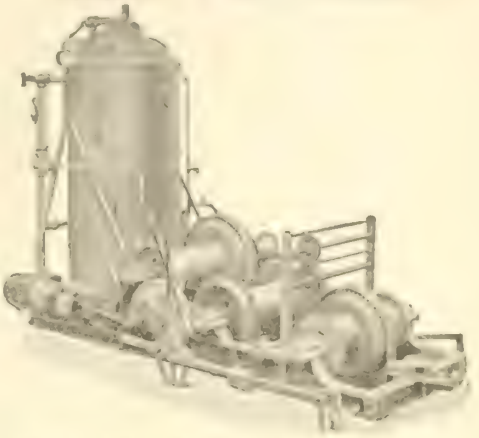

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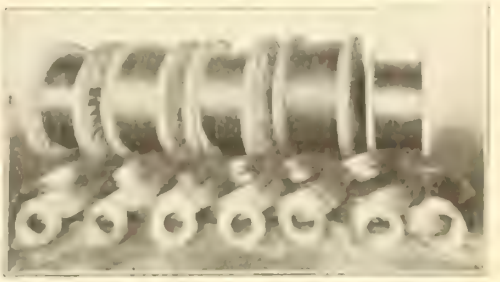

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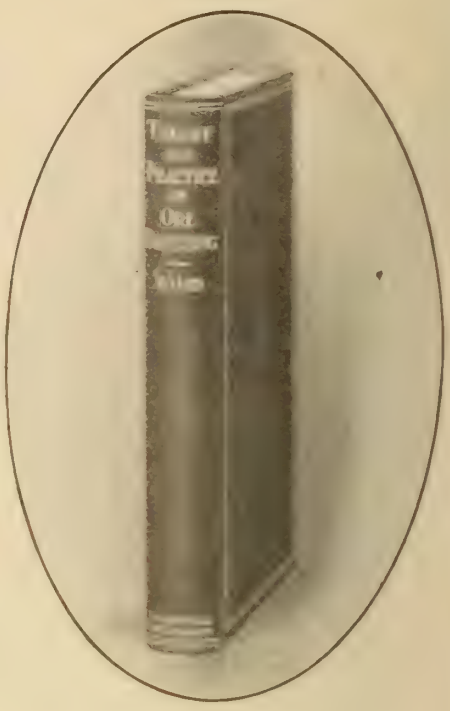

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I. Preliminary considerations, Relating to Installation of Ore-dressing Plants. II. Testing Concentrating Ores. III. Location of Mills. IV. Crushing Plant. V. Separating Plant. VI. General Dissertation on Crushing, Heavy Crushing Machinery. VII. Rolls and Medium Crushers. VIII. Means for Raising Ore or Ore and Water. IX. Grading and Grading Devices According to Diameter and Volume. X. Separation or Concentration Proper, Coarse Separation. XI. Preparation for Sand and Slime Concentration. XII. Miscellaneous Processes of Sand and Slime Concentration.

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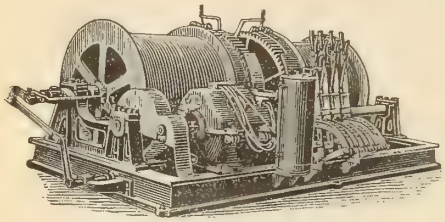

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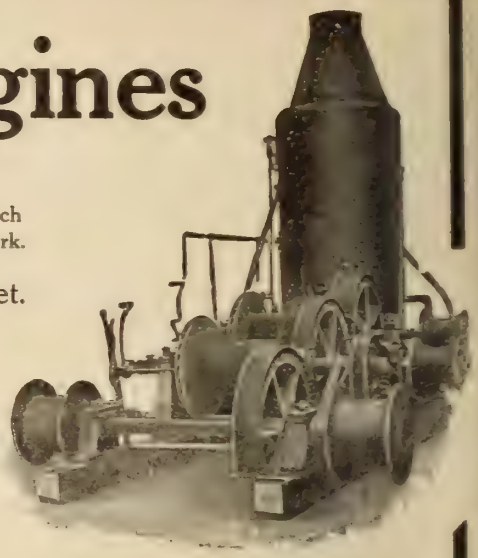

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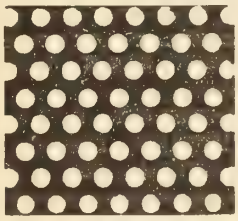

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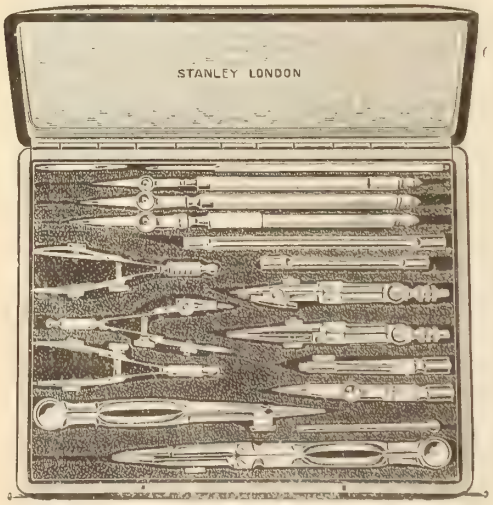

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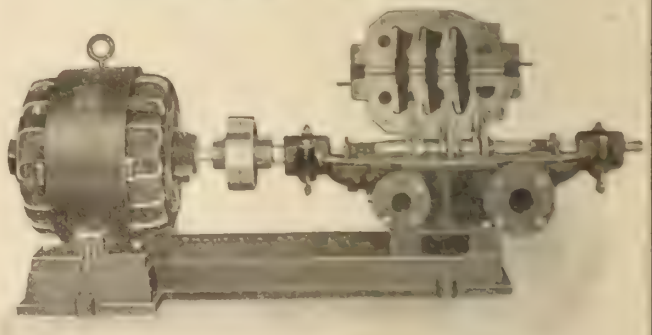

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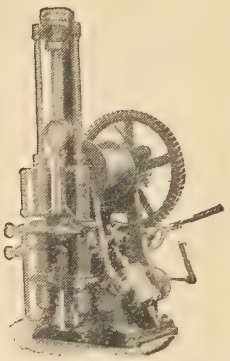

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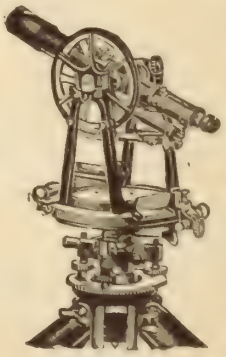

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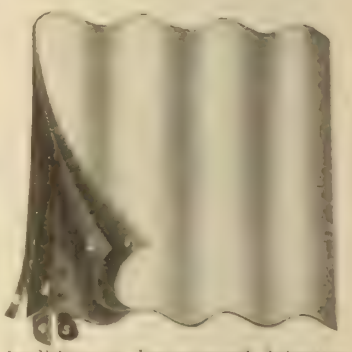

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VOL. XXXVI. TORONTO, December 15, 1915. No. 24

The Canadian Mining Journal

With which is incorporated the

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Editor

REGINALD E. HORE

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PRODUCTION IN 1916 SHOULD BE LARGE

It is becoming more and more obvious that production during the past year has been too small. A few men like Mr. Schwab realized early that the demand for metals and metal products would by this time be sufficient to tax the capacities of plants in the United States and Canada. The great majority of those responsible for the operation of mines and plants had less confidence in the future and became ultra conservative in their operations. In the early months of the war production was cut down owing to the uncertainties which the new conditions presented. Fear of the future markets deterred men from undertaking new ventures in industries in which metals are consumed. The lack of confidence naturally affected adversely the production of minerals.

During 1915 confidence has been gradually regained. The great demand for some metals early in the year resulted in increased activity in several mining districts. The good prices received for copper, aluminum, lead, and zinc and the fabulous prices obtained for rare metals such as quicksilver, antimony, tungsten, molybdenum, etc., have stimulated production and the search for minerals.

During the greater part of 1915 the prices of some metals were still low. The iron and steel industry was notably backward, but has recently experienced an almost unprecedented recovery. With a suddenness that has startled experienced steel men the industry has passed from dullness to extraordinary activity. The late summer has seen great increase in lake shipments of iron ore and now buying for 1916 has begun at an advance of 75 cents per ton. What this advance in [illegible] operators may be appreciated by [illegible] shipments during 1915 from the Lake Superior district amounted to 10,318,804 tons. There is likely to be an increase in 1916 that will tax the capacity of the fleet.

More particularly affecting Ontario has been the low price of silver in 1915. It had been expected that production from the Cobalt district would be smaller than in previous years owing to the decrease in high grade ore. The low price which has ruled has however resulted in a very much larger decrease in production [illegible] would otherwise have been recorded. Recently silver mine operators have been delighted with an increase in price from 49 to 60 cents per ounce and those who have been producing and holding the product have had a chance to sell at good prices.

Ontario's greatest mining district, the Sudbury nickel-copper district, after experiencing great activity in the

early months of the war is now producing much greater quantities of nickel-copper matte than ever in its history. There are more men employed at the mines and smelters, wages have been increased and the operating companies are making greater profits.

British Columbia's great copper mines are now being drawn upon at a rate which will help to make up for the falling off in the early months of the war. At Trail the production of gold, lead and copper has been increased and plant is being installed for the refining of copper matte.

The increase in gold production in Ontario in 1915 will be very large. The output in 1914 was $5,529,767, while the total for this year will be about $8,000,000.

The great improvement in the mining industry in 1915 augurs well for 1916. A year ago prices of most metals were still low and many seemed afraid or doubtful of the future. To-day high prices are the rule, and the demand is increasing. Confidence in the future is becoming more general. The signs all point to 1916 being a big year in the mining industry in spite of, and partially because of, the war.

It is a pleasure to be able to record such improvement as has taken place during 1915 and to so anticipate the future, for never was there greater need of production being large. The desirability of increasing production of grain during the war has appealed both to the agricultural population and to the people generally. The average person knows less about mining than about farming, and is not so likely to appreciate the fact that mining is a basic industry on which we can depend for the maintenance of our country's credit. It would be very desirable if the public could be made to realize that increase in Canada's mineral production is important for the general welfare. It does not mean only increased profits for operating companies. It means increased employment at good wages, increased markets for manufactures and farm products. Moreover, the production of minerals, whether profitable to the operators or not, is a direct contribution to the wealth of the nation. Why leave gold in the ground when it would command such high rates of interest as obtain in these days?

COAL MINING IN AMERICA AND EUROPE

Very considerable interest has been created in mining circles in Great Britain by a paper read before the North of England Institute of Mining Engineers by Samuel Dean, in which Mr. Dean argues that the principal reason why America leads in the production of coal per man employed is because large capacity mine cars are used in the United States.

The Engineering Supplement of the London Times comments as follows, dealing with the question, of course, from an English point of view:

"In this country mine cars, or tubs, of about 1,000 lb. capacity are in general use, while in the anthracite regions of Pennsylvania the capacity ranges from two to five tons, with an average of about three and a half tons. The best American cars are fitted with roller-bearings, and spring draught-gear, which reduce the heavy load at starting and the amount of draw bar pull due to friction. Another cause of the high production per man in America is the extensive use there of coal-cutting machinery. In 1913 more than half of the total amount of coal mined in America was machine-cut. Constant improvement is being made in the type and details of coal-cutting machinery, and the once popular pick or punching machine appears to be giving place to the turret or overcutting machine, and the shortwall or continuous cutter. The latest improvement is said to be a combined cutting and loading machine. Electricity is the favorite motive power in American coal mines, and it is used with less restriction than in England; notably, the use of electric trolley locomotives is permitted. Notwithstanding the vaunted thoroughness and efficiency of German methods, the average output of coal per man in Germany is only 300 tons, as compared with 760 tons in America. In this connection, Mr. Dean points to the significant fact that coal-cutting machinery is in its infancy in Germany and mine cars are ridiculously small. Considering the proverbial deliberation and caution with which radical changes are made in this country, it is highly improbable that any considerable or rapid revolution will take place in our mining methods. Changes, however, there must be and it is wise that in making them, we avail ourselves of the experiences of other countries."

In comparing the production of coal per man employed as between the United States figures and those of Great Britain and Continental countries, however, allowance must be made for the extraordinarily favorable natural conditions under which coal is mined in the United States. In the coal regions of that country the coal seams are in many instances very thick, but slightly inclined, clean and free from dirt bands, with an analysis varying within narrow limits, favorably situated for haulage and drainage, and persistent over very large tracts of country. Nowhere, perhaps, in the world can coal be so easily and conveniently mined as in some parts of the United States. In Great Britain, on the other hand, the thickest and best seams are to a large extent exhausted, and coal is being mined from thin seams, in many instances at a great depth. Inferior seams are being also worked, scientific preparation of the coal by screening and washing being relied upon to produce a marketable fuel. What is true in this regard of Great Britain is true in a greater degree of Germany. The coal-seams of that country are notably impure, and occur in seams that are much contorted, presenting problems that would cause much worry to those who have had nothing more difficult to tackle than the problems say of the Pennsylvania coalfield. It is the "brassy" impure nature of the German coals that has forced the Germans to be pioneers in the washing and preparation of coal. It is therefore rather a misleading statement to remark, as the Times writer does, that "notwithstanding

the vaunted thoroughness and efficiency of German methods, the average output of coal per man in Germany is only 300 tons, as compared with 760 tons in America." It is also typical of the self-depreciating fad of the Englishman to infer, as the Times writer infers, that the science of coal extraction is less understood in Great Britain than in the United States. It has not yet become necessary in the United States—or in Canada, for that matter—to work thin and inferior coal-seams, such as are being so largely worked both in Great Britain and on the Continent of Europe. Such luxuries as "payment on a screened coal basis," and "blasting out of the solid," cannot be afforded in old-fashioned Europe, and the number of tons of coal produced per man employed is not always a true criterion of efficiency. The condition of the coal produced is an important consideration, and one often overlooked in the desire for tonnage records. —F. W. G.

AVOIDABLE FIRES IN COAL MINES

The following extract from the Engineering Supplement of the London Times for October last should be of interest to practical mining men, because of its excellent common sense. The excerpt, which is headed "Plain Causes," is as follows:

"The circumstances attending the fire which occurred last month in the downcast shaft of the Exhall Colliery afford another illustration of the danger which may at any time result from obvious and easily avoidable causes. In this instance fourteen men lost their lives as a consequence of the overturning of a naked paraffin flare lamp carried by a man who was in the act of oiling some machinery in a shaft containing pitch-pine cage conductors. Although in the case of a new shaft the adoption of wooden guides is objectionable on account of their inflammability, it may be unreasonable, on the ground of cost, to require the substitution of steel guides for wooden guides in small or old collieries. At the same time, where wooden guides are in use, it seems to be obvious that extra precaution should be taken against accident by fire, and especially that the use of flare lamps in the shaft should be absolutely forbidden. Authorities, both legislative and administrative, have a peculiar faculty of neglecting the simple and favouring the recondite; and it is only by repeated lessons of a nature similar to that afforded by the Exhall disaster that they can be induced to give due consideration to plain facts. A striking illustration of this contention was to be found, until comparatively recently, in the legal attitude adopted in regard to persons employed below ground in coal mines having fiery mixtures in their possession, such persons, on conviction, being usually let off with a fine, although the potential danger to hundreds of lives involved by such an offence is apparent to the meanest capacity. There are even now probably many simple causes of danger existing in coal mines, and if the authorities would endeavour to collect, investigate, and remove them, they would not only considerably reduce the annual tale of accident and misadventure, but they would also, and at the same time, clear the ground for their more abstruse researches."

It is [illegible] that the custom of the naked light in coal mines still persists. The great bulk of all coal mine explosions and fires are traceable to the presence of a naked light. It would be a different matter if naked lights could not be avoided. A naked light coal mine to-day is an anachronism, as obsolete as the "steel mill" method of illumination, or ventilation by a furnace fire. A worse evil than the naked light mine even is the "mixed light" mine, where safety lamps are used in certain sections classed as gassy, and naked lights used in the other parts of the mine. The use of flare lamps around stables and shaft bottoms has caused fires innumerable, and yet this sort of thing persists. Elaborate laboratory experiments on the explosibility of coal-dust, and analysis of mine air, the composition of explosives and many other nice scientific problems that have come into great prominence in recent years, have led to important results and increased safety in coal mines, but all this recondite research is of little avail if the dictates of ordinary common sense are neglected. Many a man will use a naked light in a coal mine without thinking very much about it, who would hesitate to use a match or a lighted candle in his own attic. Nothing has had, or can have, so deterrent an effect on the occurrence of mine fires and explosions as the absolute abolition of naked lights underground. Without discussing the comparative merits of oil safety lamps and electric lamps, it may be stated that both oil and electric safety lamps have been brought to a state of great efficiency, and that adequate illumination is obtainable with more or less complete safety in use. There is to-day no excuse for the exposure of a naked flame in a coal mine.

The advantage of using a large volume of air in mine workings is seen in the results obtained at the Morro [illegible] mile below the adit level, the temperature was 105°, but, on account of the large volume of air passing, the men did not seem to be much affected. It is expected, however, that artificial cooling of the air will be resorted to.

The prosperity of the aluminum industry is indicated [illegible]

Comparatively few reports on oil and gas have been published by the Dominion and Provincial Governments. During the past month, however, we have received copies of two important contributions. The Bureau of Mines of Ontario has published a report by Mr. Cyril W. Knight, Assistant Provincial Geologist, on Oil and Gas in Ontario, and the Mines Branch, Ottawa, has published a second volume by Frederick G. Clapp and others, on the Petroleum and Natural Gas Resources of Canada. Those who are interested in the oil and gas industries will welcome these publications. Copies can be obtained free on application to the respective departments.

The iron and steel industry has had its share of bad times, but is now well on its way to a period of unprecedented prosperity. It is stated that the U. S. Steel Corporation is now being offered 60 tons of business for every one ton that was offered at this time last year.

Interest in the flotation process of treating ores is becoming quite general, and members of the Canadian Mining Institute are fortunate in having Mr. T. A. Rickard and Mr. E. P. Mathewson promise papers on this subject for the annual meeting in Ottawa in March, 1916.

Lieut. Neil 'Foghorn' Macdonald wants chewing tobacco for his men in the trenches. The Secretary of the Canadian Mining Institute has forwarded a supply and will be pleased to receive contributions.

BELGIUM'S MINERAL RESOURCES IN AFRICA.

Two representatives of the Belgian Government are expected in the United States shortly for the purpose of raising a loan for that country, according to cable advices. This raises the interesting point as to what Belgium would have to offer, provided collateral were demanded.

Its Congo Free State remains as a free asset, and within the confines of that vast territory are believed to be mineral deposits of great wealth. American capital has been invested there through concessions granted by the late King Leopold, one of which went to the American Congo Co. for rubber grants, and the other to the Societe Internationale du Forestriere et Miniere for mineral and timber rights.

The rubber concession was secured through the efforts of Thomas F. Ryan and the mineral-timber rights by A. Chester Beatty, a well-known mining engineer, who obtained them through a personal visit to King Leopold at Brussels. Thus far, at least, the rubber concession has not proved profitable. Development of the mining properties has been conducted for the past nine years with favorable results.

Ownership of stock in the Societe Internationale du Forestriere et Miniere is understood to be evenly divided between the Belgian Government and a number of Americans, including T. F. Ryan, members of the Guggenheim family, A. C. Beatty and several others, Mr. Ryan being the largest stockholder.

Drilling for oil has been pushed, while metals have been sought. The concession covers about 18,000,000 acres. New York at present directs its affairs, owing to Belgium's stress.

PROFESSOR JAMES FURNAM KEMP, who has been forced, through illness, to take a prolonged rest from his duties at Columbia University.

CONSOLIDATED MINING AND SMELTING CO.

Shareholders of the Consolidated Mining and Smelting Company of Canada have received a circular announcing the issue of a new block and including a statement of the affairs of the company. The right of shareholders to subscribe to one new share for every five held, at par, is already known, shareholders being those on record on November 12. The right to subscribe will expire at noon, December 15.

The company has had a busy year. The circular indicates the remarkable expansion in the company's capacity for production. When plans now being carried out are complete the lead capacity will have been increased 60 per cent., and on a more economical basis. Not only is the company in a position to produce zinc commercially, but at the request of the Shell Committee at Ottawa a zinc production plant was installed at Trail to have a daily capacity of thirty-five tons of refined zinc. This involved a substantial expenditure on capital account. The zinc output for 1916, however, has been ordered by the committee at profitable prices.

The Shell Committee also requested that the company should undertake the refining of copper—a new Canadian industry. While this new departure will be carried forward on a limited scale at first, it is expected to develop and involve the treatment of much of the matte and blister copper taken from British Columbia mines. The committee have ordered at fair prices the output of refined copper during 1916.

ALGOMA STEEL.

The Algoma Steel Corporation, in common with the other large steel companies of Canada, is booked up months ahead. The change in the company's position since before the war is the result of the heavy demand for steel required for the manufacture of shells. All orders now on the books of the corporation are at good prices.

METAL PRODUCTION IN ONTARIO

Returns made to the Ontario Bureau of Mines show that the production of the metalliferous mines and works of the Province for the nine months ending 30th September, 1915, was as follows. The table also shows the changes as compared with the same period of 1914.

	Value.	Increase.
Gold	$5,826,941	$1,884,093
Silver	8,030,469	*2,051,760
Copper	2,024,658	359,762
Nickel	5,369,536	1,345,980
Iron ore	601,044	221,126
Pig iron	4,510,906	*1,933,307
Cobalt ore	12,472	14,091
Cobalt metal	66,552	66,552
Nickel metal	4,762	4,762
Cobalt and nickel oxides, etc.	124,088	*331,403

*Decrease.

Gold.—The increase in the production of gold amounts to one-third. The gold districts of Northern Ontario are fulfilling the prediction made several years ago that they would make good the loss caused by the waning of the silver mines of Cobalt. Thus the combined value of the gold and silver output of the first nine months of the present year was only $167,661 less than for the same period of 1914, notwithstanding the fact that the yield of silver fell off over 20 per cent. Part of this decrease is due to the low prices which prevailed during the whole nine months, but which made a sharp and decided recovery in November. In gold the Porcupine mines make an excellent showing, practically every mine on the list having increased its output. Hollinger continues to lead, being now coupled up with Acme, whose ore is treated under the same roof. The new producers are Dome Lake in the Porcupine camp, and Dominion Reduction Company, from the latter's spectacular free gold property in Munro township.

Silver.—Nipissing heads the list of silver mines at Cobalt, with Mining Corporation of Canada, Canadian Kerr Lake, Sanderson-Cobalt, Crown Reserve, Temiskaming following in the order named. Silver to the extent of 50,527 ounces was recovered from the bullion of the gold mines.

Nickel.—The Sudbury mines are being worked to the maximum capacity, and the production of nickel for the nine months nearly equals the largest previous output for a full year. Over 75 per cent. of the output is made by the Canadian Copper Company, but the operations of the Mond Company are now more extensive than formerly, and its output has correspondingly increased.

Copper.—The yield of copper was also much greater than in the corresponding period of 1914 and nearly equaled the total output of that year. It was all obtained in the Sudbury matte, which are sent to Bayonne, N.J., and Orford, Wales, for final treatment.

Iron.—The shipments of ore show an increase, the output coming from Magpie, Helen and Moose Mountain. Stock piles were drawn upon of the two latter, and a limited quantity of hematite was marketed by Moose Mountain. The output of pig iron suffered a decrease of 28 per cent. in quantity and a slight lowering in the average selling price per ton.

Cobalt and Nickel Metal.—Metallic nickel and cobalt are now produced from the silver ores of Cobalt by the smelters at Deloro and Thorold. Of the former 98,216 pounds and of the latter 24,962 pounds were made and shipped during the nine months. The trade in cobalt and nickel oxides has been heavily affected by the war, and the quantities shipped were much below those of the corresponding period of 1914.

Molybdenite.—Efforts are being made to produce molybdenite, which is in demand in England for the manufacture of steel for ordnance-working tools. The British Government has requisitioned all supplies of this mineral arriving in Britain at the rate of 105 shillings per unit delivered, on the basis of 90 per cent. concentrates. Molybdenite occurs in pockets in many parts of Eastern Ontario, and there should not be much difficulty in obtaining a considerable supply to help meet the needs of the English steel makers.

INTERNATIONAL NICKEL CO.

For the first seven months of the current fiscal year, profits of International Nickel Co. were about $1,000,000 ahead of entire preceding fiscal year. Profits are running not far from $1,000,000 a month, and with five months remaining to complete the fiscal year, profits will be approximately $6,000,000 ahead of last year.

The company has in the treasury between $7,000,000 and $8,000,000 cash, besides $1,000,000 of the Anglo-French loan paid for. A considerable increase of treasury cash over present amount is certain by close of the fiscal year March 31st.

Prospects for extra dividends in March are more than promising. The company, being a mining and smelting concern doing a strictly cash business, does not require large working capital.

Plan to split the common stock into shares of $25 par is being well received. Investors argue that desirability of a stock depends on security of investment, remunerative dividends, and, not least, availability as an asset and use as collateral. In case of $100 shares selling at 200, availability was lacking, as the stock had become entirely an investment issue in which often one had to sacrifice several points to sell a few hundred shares; the same applied to re-investing proceeds [illegible]

The company is now paying 5 per cent. quarterly. It recently paid a 40 per cent. stock bonus, which with the stock at 200, is equal to 20 per cent. Even if shareholders do not receive any further extra dividends in the present fiscal year, it will still have paid 40 per cent. for 12 months.

A smaller percentage of output is now consumed in manufacture of munitions than [illegible] the war, despite the fact that sales of nickel have largely increased.

The customary increase in production of automobiles is an important item in consumption of nickel. It is used to strengthen the steel in some of the cars, but especially in toughening various parts of the machine, the latter are frequently 30 per cent. nickel.

While increasing [illegible] International Nickel Co. has made an attempt to prevent [illegible] trade. Refined prices for nickel are barely half [illegible] formation of the company. Its aim is [illegible] consumption of nickel by extending [illegible] advance would tend to discourage employment.

The big advance in [illegible] profits of the company's [illegible] receipts about 3,000,000 pounds of copper a month.

Boston News Bureau.

THE PRODUCTION AND USES OF RADIUM

U. S. Secretary of the Interior Lane has through the U. S. Bureau of Mines made public the methods whereby the Bureau has been able to produce radium for less than one-third its present selling price. The cost of radium at the Denver Experiment Station of the Bureau, including the higher cost of the first experimental work was $37,000 for each gram of radium metal. The market price of radium for the last two or three years, according to the Bureau of Mines, has been from $120,000 to $160,000 per gram.

"The result of the ability of the Bureau of Mines to produce radium for $37,000 a gram," said Secretary Lane, "has at least made it possible for two great hospitals in the country to obtain a goodly supply of radium for use in the treatment of cancer, that dreadful disease that is costing the lives of 75,000 human beings every year in the United States. Up to the present time, five grams of radium have been extracted from the carnotite ores and about half of it has been delivered in finished form to the Kelly Sanitarium in Baltimore and to the Memorial Hospital in New York.

"The Bureau of Mines produced this radium in cooperation with what is known as the National Radium Institute, which was organized for the purpose of studying the curative properties of radium and not for private gain. These investigations have from the first been under the direction of Dr. C. L. Parsons of the Bureau of Mines, the funds being furnished under cooperative agreement between the National Radium Institute and the Bureau of Mines by Dr. Howard A. Kelly, of Baltimore, and Dr. James Douglas, of New York.

"The application of radium in the treatment of cancer and other malignant growths has made much more rapid progress in the last two years than is generally appreciated even by the medical profession. All kinds of opinions may be easily had from the laity and from cancer experts, and the public can draw almost any conclusion from the statements appearing in the newspapers, but preference should be given to the opinions of those persons who have had extended experience in the use of radium in sufficient quantities to enable them to speak authoritatively.

"One thing regarding radium therapy that has been developed is that if the gamma rays of radium are to be successfully applied to the cure of cancer, a much larger quantity of radium must be used than is possessed by not more than two or three individual surgeons or hospitals in the United States. I know of no individual or hospital that has had the privilege of working with so much as half a gram of radium that does not report cures in increasing number or that is not able to treat even advanced cases with increasing success as a knowledge of technique is developed. The extent and variety of cures reported and the helpful effects of the gamma rays at depth are almost in direct proportion to the quantity of radium that can be applied at one time to the patient. I do not mean that radium in comparatively small amounts may not be effective with some forms of cancer or some malignant growths in their incipiency, but in two American hospitals that have a half a gram of radium or more, results are being obtained daily that unquestionably will not be duplicated elsewhere until equal quantities are available. Physicians and surgeons who do not have this much radium have no right to criticize or condemn the physicians who have more and who are obtaining results.

"At the time the bureau began its radium investigations, the miners and prospectors in Colorado and Utah, who were engaged in the mining of carnotite ore, were receiving between $75 and $80 a ton for their ore, this price being for the ore delivered in New York, for shipment to Europe. The ore was being sent abroad in quantity and was not being treated in this country, although one or two companies were rapidly purchasing from prospectors claims at $50 to $200 and thereby laying the foundation of a future possible monopoly in this rare material. It was hoped that methods could be found that would enable miners and associations of miners to extract the radium from their own ores, place it on the market, and obtain profits that had been going to foreign manufacturers. By August, 1914, when the European war came on, carnotite ore was selling for more than twice the price that had been obtained in the summer of 1912, this being undoubtedly due to the Bureau of Mines calling attention to the situation as it existed at the beginning.

"At this time, there were sixteen to twenty grams of radium contracted for abroad, chiefly in Germany, at prices above $120,000 a gram. Seemingly the war has not affected the market price but simply the amount produced.

"As to the selling price of radium in the future, the Bureau of Mines makes no prediction, but it does not follow that the selling price will decline because of the cheaper methods of production. The situation is somewhat analogous to the production of gold, diamonds or any other material that is in steady demand but occurs only in small quantities. Beyond doubt, the amount of radium in nature is exceedingly small. Other deposits of radium ore may be found, but it is highly improbable that the past rarity of radium ores will be greatly modified, so that the price of the radium will largely depend on the ability to procure the raw material.

"According to the best evidence that the Bureau of Mines can obtain, there is not sufficient ore available to maintain for many more years the rate of production in 1914.

"When this radium work was taken up, it was the desire of the department to show beyond doubt that, if authorized by Congress, the radium could be procured from ores then owned by the people at a cost approximating one-third the market price, and that it was much better policy for the Government to obtain the radium so greatly needed in the hospitals of the army, navy, and Public Health Service at this low cost than to give these ores to large corporations and then purchase as radium material that had belonged to the people, at a price insuring large profits to the possessors. Unfortunately, the bill introduced into Congress in 1914, which would have accomplished this purpose, failed to pass and in the meantime the carnotite areas have been thoroughly prospected and the most valuable claims located. Accordingly we must be content with the good that may come to the American people through the radium being extracted in the plant of the National Radium Institute until such time as the Government may furnish funds sufficient to enable it to purchase in the open market such ore as may be necessary to supplement the little that remains unlocated on Government land.

"The report of the bureau on this new and cheaper method of producing radium from carnotite ores is highly technical in its character and will only interest

those chemists who are engaged on such work. The methods devised are entirely new and differ from former methods not only in detail but in apparatus used. The time of operation is much shorter than in any other plant now producing radium and the commercial recovery is much greater. Furthermore, it is believed that the cost of production is less than that in any method used heretofore. It should be remembered, however, that the methods apply solely to the treatment of carnotite ore and are not necessarily applicable to pitchblende or autunite. The methods of extracting the radium that have been evolved may be utilized under intelligent technical control by any firm, association, or corporation that can obtain the raw material. Although being patented for the benefit of the people, the processes may be used freely by anyone within the United States."

BEAVER CONSOLIDATED

Under date of Dec. 8, 1915, President F. L. Culver in a letter to the shareholders of Beaver Consolidated Mines, Limited, says in part:

"During the quarter ending Nov. 30 we have been pursuing our policy of aggressive development. The main shaft has now reached a depth of 1,235 ft. The station is being cut at the 1,200-ft. level and when completed, sinking will be resumed, as we wish to reach the lower contact between the diabase and Keewatin formations as quickly as possible. Diamond drilling has proven that this contact exists between 1,600 and 1,700 ft. from the surface. It is believed that we will obtain values along this lower contact as we did on the contact between the 460 and 530 ft. levels. You can readily estimate the value of such a discovery. When we opened up the 200, 250, 300, 350 and 400 ft. levels, we had no concentrating mill on the property and consequently were looking for high-grade ore only. Very little work has been done on these levels since that time, but we have recently placed drills back on the 200-ft. level and will explore these levels thoroughly for mill rock and possible high-grade. So far the results have been very good. The addition to the mill has been completed and it is now treating from 125 to 150 tons daily.

"We presume you are familiar with the phenomenal gold discoveries which have been made north of Cobalt and the large gold mines which are now operating in that district. The directors have been making investigations for some time in the hope of obtaining a property with sufficient showings to warrant them in making an offer so as to attach a gold property to your already large holdings, and recently we have taken an option on the stock of the Kirkland Lake Gold Mines Limited. This company owns 365 acres of land in the Kirkland Lake District, in the Township of Teck. One of the claims, known as the McKane lot, touches the Tough-Hughes, which property is now being operated by the Buffalo Mines Limited of Cobalt, who are building a large mill for treating the ore which they have in sight. The Lake Shore Mining company, which has some excellent showings, is operating a short distance from the Kirkland Lake property. The Tough-Oakes mine, which is now producing about $80,000 a month and is fast developing into one of the big mines of the Northern country, is a little over a mile away. This company has recently entered the dividend-paying class and will pay its second dividend on January 3, 1916. These properties are all in the same mineralized zone. On the McKane lot of the Kirkland Lake property is a fully equipped plant consisting of two boilers, a small compressor and sufficient mine buildings. A vein has been discovered on this lot and proven for a distance of 1,400 feet. A shaft has been sunk on this vein to a depth of 79 feet, from which our engineer has obtained assay values as follows: $262, $156, $182, $46, $48, $120, $131 and $180. Our agreement with the Kirkland Lake Gold Mines Limited provides that we are to expend at least $2,000 a month on development for the next year. At the end of that time we will be in a better position to determine whether or not it will be advisable to take over the company and its assets. In the meantime, all of the stock of the company is being held in escrow, but as our development progresses, it is arranged that we will receive stock from month to month for our expenditures. At the end of the year, if the development proves satisfactory, we can then exercise our option by taking up the balance of the stock at prices which we deem to be very attractive.

November 30, 1915: Bullion in storage, 57,296.18 oz.; ore at smelters and in transit, 126,779 oz.; ore bagged at mine, 35,940 oz; total, 220,015.18 oz.; cash on hand, $122,674.24.

"On October 15th we paid a dividend of 3%, distributing $60,000 among the shareholders. The price of silver has advanced considerably during the quarter, the quotation on November 30th being 56⅜c. an ounce as against 46¼c. on September 1st."

IMPROVEMENTS AT TRAIL SMELTER

At Trail, the smelting centre for Kootenay ores, important progress is manifest. Of course the greatest activity is at the Consolidated Co.'s smelting and refining works, where many improvements and additions have been made during several recent years. In fact, there has been an almost entire transformation of the [illegible] of the works, old buildings and plant having been gradually replaced by larger modern structures and equipment, thus providing for a considerably increased ore-treatment capacity and this at reduced cost. These comments apply to both lead and copper-smelting departments. Larger storage bins for ores with ample provision for bedding so as to secure generally uniform charges for the blast furnaces, enlarged and improved sample mills, better transportation arrangements between ore beds and furnaces, bigger blast furnaces for both copper and lead, an overhead electrically operated crane for handling matte pots, the substitution of Wedge roasters for the old Huntington Heberlein [illegible] and [illegible] belt-conveyors for handling materials in and from the roasters, several treaters of the Cottrell system for precipitating metals carried from the furnaces in the flues and stacks, and many other improvements mean expeditious and economical treatment of ores and furnace products and, as well, for improving working conditions for the men employed in the smelter. Methods at the company's electrolytic lead refinery [illegible] up to date. Excellent progress has been made [illegible] The completion of installation of copper converting plant will be generally welcomed. [illegible] the local officials that it will not be long before copper refining by the electrolytic process will be undertaken here. Meanwhile the buildings and equipment for the refining work are being erected and [illegible] by the company's own employees. [illegible] make quality at Trail enough to [illegible] [illegible] are not relative to the further development of the company's activities.

THE VALUATION OF METAL MINES*

By T. A. Rickard.

The present value of a mine is based on an estimate of future profits. The profits are expressed in terms of money. The value of money differs with time and place. While money is unlikely to differ in value notably in the same place during the relatively short life of a mine, it is likely to be affected by the condition of locality. Money is worth less at New York than at Tonopah, for example, the prevailing rate of interest in the one case being 4 or 5 per cent., and in the other from 8 to 12 per cent. per annum. This difference tends to facilitate the transfer of a mine from an owner in the desert to a capitalist in the city. The latter is content with a smaller return on his "investment," as he is apt to call it. The difference in the point of view tends to promote business.

In all business transactions the point of view is vital; hence the difference between the valuation of mines for purchase and the appraisal of them for taxation. Attempts have been made to put both kinds of estimation on the same basis. They have failed. The purchaser buys a mine to hold it and to exploit it until it is exhausted; when the purchase is completed, he cannot revise the transaction. If he buys with the idea of re-selling, he must do so on the supposition that the next buyer will act intelligently; that is, as a sensible man, the purchaser cannot assume an escape from a blunder by the interposition of somebody more foolish than himself. Such assumptions, it is true, are not uncommon, but they proceed on lines of reasoning outside the limits of an economic investigation. Therefore, I repeat, the purchaser whether an individual or a company, buys with a view to exploitation. The State, on the other hand, assesses the mining property annually, and is in a position to remedy any error in its estimate from year to year. The first appraisal is not irremediable; therefore it is not so momentous. Nevertheless the State authorities, recognizing the inherent difficulties of the problem and their incapacity to solve them, usually avoid them by simply taxing the output of the preceding year, that is, they prefer to deal with the statistics of actual production. They appear to recognize, or they may have merely surmised, that the ante-mortem diagnosis of a mine is necessarily aberrant. In truth, it is a tricky business. Having regard to the inherent difficulty of estimating future production, it is not surprising that the taxation of output has been adopted in most States as the most practicable method. It seems best for the purposes of annual taxation, even though it may fail to penalize those owners who choose to leave their properties idle in the hope of selling them at a higher price or of exploiting them when the market for their product is more favorable. This evasion can be checked, to some extent, by taxing the claim-area or acreage, whether productive or not, to such a degree as to render long idleness prohibitive.

The appraisal of mining properties for State taxation has had the good effect of drawing public attention to a subject heretofore deemed too recondite for general discussion. Mining engineers, among themselves and in the technical press, have touched upon the problems involved, but, on the whole, the solution of these problems has been deemed in the nature of a professional secret, to be left in the safekeeping of the individual. The active members of the profession, or practitioners, it may be inferred, consider it impolitic to publish the particular basis on which any one of them might see fit to value a mine for his client. If an engineer were to state beforehand that he could not report favorably unless certain fixed conditions were fulfilled, he might cause sundry vendors to object to having their property subjected to a test so exacting as to render business impracticable, with the further unpleasant consequence of placing a black mark against the name of the mine. Moreover, the criteria to be used in valuing different mines by the same engineer would vary in accordance with the character of the mining and of the client. In some kinds of mining the uncertainties are vastly greater than in others; so also some clients are willing, and can afford, to take bigger risks than others. For reasons of this kind the scheme of valuation is rarely set down in black and white, not even for professional information, much less for public enlightenment.

Within recent years, however, the State of Michigan engaged a mining engineer of acknowledged repute, Mr. J. R. Finlay, to make an appraisal of its mining properties for purposes of taxation. Other state commissioners had tried to perform the same task under the guidance of politicians, labor leaders, geologists and various gentlemen distinguished by varying lack of fitness for the task. In this respect they were like the lay public, which is learning slowly and painfully that the only person likely to value a mine successfully is a mining engineer equipped with the requisite training and experience. It is fair to add, however, that the State of Wisconsin deputed the study of mine valuation and assessment in its zinc-producing territory to a member of its Geological Survey, namely, Mr. W. L. Uglow, whose report gives the impression that he also, although probably less versed in the management of mines, has envisaged the subject with convincing skill.

The official reports† issued as a sequel to the investigations made by Messrs. Finlay and Uglow furnish an excellent text for a general discussion of the subject. Mr. Finlay states that his appraisal is "a calculation of the value of mines to the permanent owner for the production of minerals." The value of a mine for share-market purposes is ignored; so is its value for the purpose of re-sale. Neither aspect of the problem came within his province. The calculation is based on three factors:

1. The average cost of production
2. The average price obtained for the product
3. The future life of the mine.

The first two are determined "by experience," that is, they can be ascertained by investigating the records of the mine and of the industry, with sagacious inferences therefrom. The third factor is "based partly on developed ore and partly upon an assumption of continuance of known orebodies beyond the present bottom levels of the mines."

From these three factors the future net profits, or dividends, are calculated. The present value of such dividends is then reduced by the annuity method to a sum upon which they will pay a given interest and at

*A paper presented at a meeting of the International Engineering Congress, 1915, in San Francisco, Cal., Sept. 20-25, 1915.

†"Appraisal of Mining Properties of Michigan," by the State Board of Tax Commissioners, 1911. "A Study of Methods of Mine Valuation and Assessment" Wisconsin Geological and Natural History Survey, 1914.

the same time provide an annual contribution into a sinking fund, which, re-invested, and added to prior installments similarly invested and re-invested, will redeem that sum within the period covered by the life of the mine. Mr. Finlay took 5% as the dividend interest and 4% as the rate of amortization. This may be accepted as adequate for the particular, and relatively safe, type of mining illustrated by the copper and iron deposits of Michigan, but in precious-metal mining, which is more hazardous, the rate of dividend should be at least 10%, with the possible exception of a few orebodies of extraordinary uniformity.

This method, of course, ignores unprofitable mines. It is also inapplicable to prospects. On the other hand, the mere discovery of mineral on land may give it an immediate and taxable value, to be determined on a different basis, as is shown in Mr. Finlay's report. In the productive copper mines he had a relatively simple problem. For instance, in the case of the Wolverine, the records showed that during the preceding five years the necessary data were as follows:

Yield of copper per ton of ore, 26.7 lb.; cost of producing copper per pound, 7.65c.; average price of copper per pound, 15.60c.; profit during the five years, $3,896.270; estimated total future production of copper in pounds, 80,000,000; valuation of the mine, $3.700.000.

The Wolverine orebody represents an enriched portion of the Kearsarge lode, which consists of a layer of amygdaloidal diabase impregnated with native copper. The lode has a fairly regular dip of 40 deg. and has been traced on its strike for five miles through a series of most productive mines. Mr. Finlay assumed, or "calculated with certainty," that part of the Kearsarge lode will continue profitable to at least 6,000 ft. in depth and that 60% of the lode-area within the known profitable length will be mined to that great depth, yielding an average of 16 lb. copper per ton. On this basis the lode would yield 70,000,000 tons of ore, in addition to the 20,000,000 already mined. And of the grand total he credits the Wolverine with 3,600,000 tons. He gets at this by taking the surface area covering the lode on its dip at 215 acres, and the thickness of ore at 12 ft.—for the stoping-width is remarkably regular. Estimating that the reserve of ore will last for nine years, that the copper can be won at 8 cents per pound, leaving a profit (on a life output of 6 cents per pound, he obtains a total profit of $4,800,000 and a present value of $3,700,000.

In appraising the copper mines of Michigan, Mr. Finlay had no trouble in obtaining accurate data in regard to cost, for the books of the companies operating the mines were open to him. These companies are old and respectable; the technical management is first-class; any information required by an accredited investigator is given willingly and accurately. Mr. Finlay could have had no trouble in ascertaining the total cost per pound of copper. Then he had to make an estimate of the probable price of copper during the future life of the mines under appraisal. He decided that 14 cents would be fair, although personally he is inclining to believe that this was low. That was in August, 1911. Since then the price of Lake copper has been as follows:

Year	Average
1911	12.85
1912	16.50
1913	15.70
1914	13.61

His estimate needs no apology. He was making an appraisal for annual taxation; presumably therefore the valuations of the various mines could be reviewed from year to year and corrected in accordance with the rise or fall in the price of copper. If he had been valuing the mines for a purchaser, he would, by taking 14 cents as an average price, have been no more conservative than we should reasonably expect an engineer to be under such circumstances. In short, he is justified in the result.

As regards the life of the mines, Mr. Finlay could make no personal examination in the time at his disposal; he had to examine the records, with maps and sections, assisted by the willing information of the managers. On this he could rely to a degree not usual in the examination of mines in private practice. The copper mines in Michigan are well developed, the character of the orebodies is well understood, the relative persistence of the ore has been ascertained. Indeed, the non-persistence beyond a known horizon helps the appraiser, who is not called upon, as in some regions, to give serious thought to dreams of unlimited continuity in depth. The length of ore likely to be extracted is, in most cases, determined either by the boundaries of adjoining properties or by exploratory work, for the intelligent mine-operator endeavors to ascertain these fundamental facts as soon as possible, in order to plan intelligently and to equip providently. Therefore I conclude that Mr. Finlay's estimates of "life" were so correct as to afford a safe basis for the appraisal required by the Tax Commission.

Turning to the similar effort at scientific valuation in Wisconsin, two years later, it will be found that Mr. W. L. Uglow was instructed by law to assess mineral land at the "full cash value" it would bring "at private sale." This was understood to mean "a sum of money which engineers and business men would be willing to pay for a property if they should have full knowledge of all the facts of past production and future prospects at their command." The lack of "full knowledge" in regard to future production is, of course, the crux of the whole matter; indeed it is the one awkward factor, and for that reason it is usually pushed into an obscure background.

Conditions in Wisconsin are relatively simple. The owners of the land are mostly farmers, who lease the orebearing areas to mining companies. The latter test the ground by churn drilling and then sink their shafts in proximity to extracting the ore which lies at a shallow depth, the maximum being about 250 feet below the surface. A royalty of about 10% on the gross output is paid to the owner as his rent or share of the earnings. He pays the real property tax, as well as an income-tax on his rent. The ore bodies have their greatest dimension horizontally, about 10% of the ground are left as pillars, the ore consists of blende, galena and pyrite disseminated in limestone; it is submitted to concentration, the concentrate being sold to the smelting companies. The properties are small, for the shallowness of the deposits does not compel concentrated effort or big capital expenditure.

In order to get at a reasonable basis for valuing the zinc mines of Wisconsin, Mr. Uglow takes a "hypothetical one mine" built upon the figures obtained from [illegible] properties; these figures [illegible] to weighted averages over a period of four years. This four-year life is assumed on the basis of [illegible] ence. Of course, a good lot of other assumptions [illegible] to be made, such as the price of spelter, which [illegible] down as $7, 5.4, 5.0, and 5.2 cents per pound for the four years respectively. Although it is not clear [illegible]

guess should not be made uniform. Apart from the fact that the price of zinc is beyond the vaticination of any appraiser of mines, it is noteworthy that in the last stage of his valuation Mr. Uglow deducts 15% "on account of the absence of data for checking the assumed figures for grades of ore." If 15%, why not 51%?

Having constructed this hypothetical mine, Mr. Uglow applies it to ground "well drilled" and ground "poorly drilled at the outset." The present value in the one case is $168,117 and in the other $125,180 at the beginning of the first year.

Next he applies various systems of valuation to this hypothetical mine and arrives at the conclusion that the most suitable method for the zinc mines of Wisconsin is that of equated income. To ascertain the value of a mine, therefore, he multiplies the annual operating profit by 2.43, this latter factor having been determined by mathematical analyses on the assumption of equal annual profits and an average life of 4 years. He concludes that, as compared with the ad valorem method, this scheme has the advantage of being based on the estimated average life of all the mines, not a particular one, in the district; it is calculated on the actual profit of the preceding year, not upon an estimate of future profit; moreover, it is well adapted to taxation because it assesses a mine in accordance with its ability to pay, rather than its sale-value.

Again we face the fact that the valuation of a mine for purchase and its assessment for taxation constitute two different problems. The tax-gatherer's valuation is made annually, and can be revised annually, therefore it is convenient to base it upon the actual profit—not production—of the previous year. The future does not concern the tax-gatherer; he takes short views of life; it is his duty annually to collect a contribution to the revenue of the State in equitable proportion.

We shall leave him to his troubles, which are relatively small, for it is our purpose to discuss the valuation of mines for sale or purchase, which is a far more difficult problem.

Valuation for Sale or Purchase.—In order to value a mine, that is, to determine the price at which it is a reasonable purchase, it is necessary to estimate its future profits. That is done in successive steps, ascertaining:

1. The average yield per ton of ore
2. The average cost per ton of ore.
   (The difference between 1 and 2 is the "profit")
3. The tonnage available now.
4. The tonnage likely to be available in future years.

Each step demands skill and experience. The yield is determined by a careful sampling of the ore exposed in the workings, by comparison with past records, and by an estimation of the probable extraction in the mill or smelter. The metal contents as determined by assay do not represent the yield; to ascertain that it is necessary to know the percentage of extraction by the metallurgical method most suitable. Mines are bought sometimes on the expectation of applying increased skill to the extraction of the metals from the ore. The expectation may prove too flattering.

The average cost can be ascertained from past records, with corrections based upon any anticipated change of conditions. The anticipations may prove fallacious. The records may be deceptive. "Cost" is interpreted variously. Among British-owned mines, particularly in Rhodesia and West Africa, it is customary to give a figure for "cost" that omits many inevitable items of expense, such as head-office expenses, taxes, insurance, depreciation, improvements, recruiting for labor, even development and prospecting. In some cases the omissions represent discrepancies of 30% to 40% from the actual cost, giving phantom profits highly useful for share-market purposes. The big mines of the Rand issue monthly figures of profits that are illusory because in the cost the Transvaal profit-tax is omitted, together with London expenses, income tax, debenture interest, and additional expenditure on new equipment. The result is that the profits periodically announced are 30% more than the dividends. I have always argued that the profit to the shareholders, who are the owners of a mine as conducted on the joint-stock principle, is represented by the dividends that actually get into their pockets or are lodged to their bank-accounts. To many persons some of the items, such as interest and taxes, seem beside the mark. The borrowing of money on debentures, however, usually represents a miscalculation in the original estimate of initial expenditure for development and equipment. As for income-tax, it may be said that it is only a matter of book-keeping, since the collection at the source obviates later payment by the shareholder. But the income-tax on a mine is a true (and most inequitable) item of cost, for in most cases it is a tax not on income but on the return of capital. Until a mine has redeemed its purchase price, its dividends are not income. A mine is a wasting asset.

"Overhead" Expenses.—Many blunders in valuation are made by engineers owing to lack of knowledge concerning the "overhead" expenses. Any sagacious appraiser of a mine that is to be placed on the London market, and to be managed from there, should add 10 to 20%, according to tonnage of production, to his operating or local cost, if he expects to make a forecast that will stand the test of future accomplishment. Indeed, the best school for the appraiser is last year's almanac; let him read the old reports and valuations of mines now approaching exhaustion. He will see how errors were made and how estimates were falsified. For example, the small additions to equipment made from year to year may seem a minor item. No allowance usually is made for re-building or replacing the existing reduction works, yet no mill or smelter remains intact for many years, if the owners are progressive. Fires and other accidents will happen. Decay and destruction, wear and tear are inseparable from machinery and equipment. For example, the cost of new equipment at the Bunker Hill & Sullivan mine, in Idaho, averaged 80 cents per ton during 22 years, on a total operating cost of $2.66 per ton. Again, when I examined the Camp Bird mine in 1900 I found that Thomas F. Walsh, the owner, had extracted $2,535,000 worth of ore at a cost of $6.50 per ton. I estimated the ore assured at $6,000,000 and anticipated that the cost could be reduced to $5.25, in consequence of an improved equipment and larger tonnage of production. The mine more than fulfilled the expectations of productivity and profit, but the average cost was $10 per ton. The administration and general expenses of a London company proved more costly than I had anticipated, in comparison with the thrifty management of an individual owner. The reading of old reports shows that a post-mortem will give data more reliable than those obtainable from a diagnosis made while the patient is alive; unfortunately, old reports disappear to the comfort of the profession and exhausted mines cease to be interesting except to the historian, therefore this source of guidance is not readily available to the student of the subject under discussion.

Tonnage.—The ore exposed can be measured and an estimate of that which is partly exposed can be made with reasonable accuracy by an experienced engineer, that is, by one wise to the vagaries of various types of ore deposit. When, however, the next step is taken, namely, the estimation of ore likely to be rendered available in future years, as the result of intelligent development and exploration, the engineer faces a crucial problem and one that may render all his previous ratiocinations utterly futile. The test of science is prediction; the inability of the mining engineer to predict the continuity of an orebody suggests that the appraisal of mines is not a science, but an approximation based upon empiricism.

Attempts have been made to express the probabilities of ore-persistence by formulae. Some engineers allow for future prospects by adding a fixed proportion—from 20 to 35%, for example—to the ore already proved. Such short cuts are illogical. They constitute a mere surmise. Mr. H. C. Hoover has suggested that "the minimum extension of an orebody or ore-shoot in depth below any horizon would be a distance represented by a radius equal to one-half its length." This may apply to his special experience in Western Australia, but it is dangerous doctrine, for, as he himself adds: "This is not proposed as a formula giving the total amount of extension in depth, but as a sort of yardstick which has experience behind it." Another writer, with less experience and therefore greater positiveness, has offered sundry elaborate formulae for the purpose of expressing the probabilities of ore-extension in depth. These, apart from their academic interest, are interesting as indicating how many uncertain factors are involved in the calculation. They are useful as suggesting a line of reasoning, based upon the length and thickness of the ore-shoot, the number of levels already proved, and the patchiness of the lode within the ore-shoot. Indeed the methods of an actuary may be illuminating to an engineer, but the latter must realize that human life has been studied much longer than the distribution of ore underground, and that the eccentricities of human nature are better understood than the vagaries of ore deposition. Calculations based on a large number of guesses can only yield a guess. The doctrine of probabilities has been stultified in mining too often to allow of its being stated as a scientific thesis.

Having ascertained the tonnage of ore in the mine and the probable profit per ton, the engineer can say that the ore assured will yield so much money, while the ore likely to be uncovered will enable so much more money to be taken out of the mine in future years. How much does the property worth?

While the estimation of ore in most mines is hazardous, especially in the case of the precious-metal veins or lodes, it is a pleasant fact that in certain types of deposit the size and continuity of the orebodies are such as to minimize the elevation of mental outlook to the point of relative indifference of production over long periods. This is true, or has been true for many years, comparatively of the bituminous beds of Michigan, the gold-bearing of the Witwatersrand, the gold-bearing schist of the Homestake, the copper pyritic lenses of Rhodesia, and the disseminated copper impregnations of Nevada, Utah, and Arizona. However, even in these cases, it must be confessed that, for purposes of appraisal the knowledge now available has come at a late date; it has come in the wake of production, not as the result of preliminary investigation. Moreover, it is not applicable to other mines in other regions, save at great risk. Most young mines—and it is young mines we must appraise, as it is young people that we must insure—cannot be judged on the basis of experience on the Rand or in Michigan. That is why engineers with local experience in particular districts so often fail in diagnosing mines in other districts.

We return to the question: what is a mine worth, given an estimate of future profits? We have seen Mr. Finlay's formula, based on 5% for interest and 4% for amortization. I have said that his return of 5% might do in the case of the copper and iron mines of Michigan, but it was too low for most mining enterprises. Mr. Hoover says that "the mining business is one where 7% above provision for capital return is an absolute minimum demanded by the risks inherent in mines, even where the profit in sight gives warranty of the return of capital." With this, of course, I agree. Indeed, in most precious-metal mines 10% is not too much. On the other hand no figure can be stated as generally applicable. It depends upon the factor of risk, which varies in each case, not only as regards the continuity of the ore, but the capacity and honesty of the management. This feature of the problem has been well elucidated by Mr. Burnham, who asks, and answers, the question as to how much a mine ought to pay over the standard rate of interest on gilt-edged stock. Besides the addition to cover "the yearly contribution for capital redemption," he insists that provision be made for "the risk of loss of either capital or interest." Thus by the time the engineer has made his estimate of the value of ore assured and the profit therefrom, he finds his figures blown into the air by this explosion from under his very feet. These final considerations regarding the rate of return on the purchase price of the mine afford divergences so big that all the little refinements of measuring, sampling, and assaying are rendered pitifully inconsequent. If we take the standard rate of interest on national bonds as 3% and if we add to this another 4% for capital redemption we are brought face to face with the decision as to what further percentage must be made to provide for the risk inherent in mining and the final risk involved in a particular mine. Suppose we agree on the third item of our enquiry and call it 3%, even then we have the fourth item to ascertain and it is by far the most momentous in the whole of our enquiry. It may range from 0 to 100%.

Let me illustrate. Many years ago I examined a small silver mine in Boulder County, Colorado. The vein was narrow but rich. The ore-bearing ground was sampled thoroughly. The result was to show that $150,000 worth of ore could be extracted at a cost of $40,000, working through an existing adit, so that $110,000 could be earned. The owners were willing to sell for that sum, half cash and half in promissory notes. The miners below the bottom level of the adit reported that the vein was poor and broken by faults. The prospects in depth seemed to me slim. I considered it a poor gamble, because the risk of the future was [illegible] the amount estimated and [illegible] bility of finding more ore in virgin ground. Even 100% per annum, that is the return of the purchase money in one year, would not have been good enough. The future [illegible] of the mine [illegible]

[illegible] Report Book for Mining Engineers [illegible] hypothetical case the property [illegible] of one thousand $12 gold pieces [illegible]

000. Allowing for a recovery of $10 and a cost of $7.50 per ton, the profit comes to $2,464,000. The conditions specified are: (1) That the above profit is to be won over a period of 11 years, (2) the plant and equipment are to cost $183,700, and to this is to be added compound interest for two years at 5% during the time of development precedent to profitable production, (3) the capital is to be redeemed at 2½%, and (4) the purchaser is to be allowed 20% on his money. Therefore the present value is $290,000. As if this were not drastic enough, Mr. Charleton shows that on a 40% return the present value would be $4.00. This *reductio ad absurdum* shows where these methods of valuation land. After taking great pains to sample the ore and equal trouble to ascertain the profitable metallurgical recovery, after having inquired thoroughly into the question of cost and made several solemn guesses at the persistence of the ore—having solved these preliminary problems, the engineer is to choose between 5, 10, 20, or even 40% as the rate of return required to justify the "investment."

The elaboration of any calculation should be proportioned to the possible accuracy of the factors involved. Otherwise it fares no better than the New Jersey farmer's method of weighing sheep. The animal is attached to one end of a fence-rail while a bag of stones is attached to the other end. First the exact centre of the unloaded rail is ascertained, then the sheep and the bag of stones are fastened at an exactly equal distance from the centre, or fulcrum, and a perfect balance is obtained. When all this has been done with painstaking care, the bag is emptied on a clear bit of ground and the weight of the stones is guessed. Why not guess at the weight of the sheep in the first instance?

Obviously, therefore, mines are not to be appraised on the basis of an investment. Whether iron or coal mines are so different from those yielding the precious metals, or copper, lead, and zinc, as to warrant a different treatment, I leave it for others to state. My own experience has been chiefly in gold and silver mining. In the case of gold, one factor, namely, the market price of the metal, is eliminated. Just now the price of the base metals is subject to abnormal fluctuations, but even in peaceful times this element of uncertainty is an essential part of the business. Some of the bigger copper mines have reserves so large and operations so systematic that the perturbing factors are apt to be forgotten. Promoters and brokers speak of such steady producers as "manufacturing propositions," meaning that they are on an enduring basis. This, of course, is balderdash. A mine is a wasting asset. It has no goodwill; that exists in the management and is transferable to another mine, but it does not ensure the life of a particular property. The resources of a mine are not renewed; at some stage in its history they are under-estimated and conjectural, but that does not mean that they are increased; they are merely uncovered. The art of mining cannot be applied on scientific principles until two basic ideas are fully comprehended:

(1) A mine is a wasting asset.

(2) Mining is a speculative business.

To treat a mine as an investment, and to appraise it on that basis, is to ignore the cumulative facts of today and of other days. Mining is a speculation that can be made wise or foolish according as a man recognizes the inherent risk and takes his chances accordingly. As a speculation it is highly profitable when conducted intelligently. The ascertainable factors are sufficiently numerous to place a premium on trained observation and the inferences therefrom are sufficiently valuable to give an advantage to men of intelligent experience. The unknown and unknowable elements in the problem will remain so numerous and so important as to involve a risk so large, and the chance of a winning so big as to stimulate the adventurous spirit of man.

MIDVALE STEEL & ORDNANCE CO.

Boston—Marcellus Hartley Dodge, who headed the stockholders' list of Midvale Steel & Ordnance Co. with 439,000 shares on Oct. 15, had reduced his holdings to 93,800 shares early in November, according to the company's own records. Midvale sold at $77 a share at mid-October and rapidly advanced to its highest level shortly thereafter. It would appear from the records that Mr. Dodge had parted with 345,200 shares at or near the highest prices.

Although the company was formed a short time ago it now has a substantial number of stockholders as approximately 1,700 names were on the shareholders' list early in November. Notwithstanding his heavy sales, which netted him a huge profit, Dodge still outranks all other holders with the single exception of Ambrose Monell, president of the International Nickel Co., whose holdings of record give him a lead of 106 shares over Dodge. Filor, Bullard & Smyth, which firm came out of the New York Stock Exchange firm of Thompson, Towle & Co., of which Wm. B. Thompson was senior member, ranks third among the large Midvale holders.

Wm. E. Corey, with 42,084 shares in his name, Percy and William Rockefeller, John D. Ryan and others well known in the copper world, have large amounts of Midvale to their credit.

On Oct. 15 there stood in the name of Marcellus Hartley Dodge 439,000 shares. When a compilation of the stockholders' names was recently made he was down for 93,800 shares. Ambrose Monell had two blocks of stock in his name, one for 53,906 shares and the other for 40,000 shares, totalling 93,906 shares.

THE PURCHASING POWER OF GOLD.

Gold now possesses a purchasing power in Great Britain of only 70 per cent. of what it did before the war, according to a compilation by the London Board of Trade. Reduced purchasing power of fixed interest bearing investments is shown in the following tabulation:

8%	now is equal to 5.6%	in July, 1914
7	now is equal to 4.9	in July, 1914
6	now is equal to 4.2	in July, 1914
5	now is equal to 3.5	in July, 1914.
4	now is equal to 2.8	in July, 1914.

To put it in another way, in order to possess the same purchasing power, an investor receiving interest at the rate of

4%	in 1914 should receive	5.71%	now
5	in 1914 should receive	7.14	now.
6	in 1914 should receive	8.57	now
7	in 1914 should receive	10.00	now.
8	in 1914 should receive	11.42	now.

The figures bear out Sir J. Harmood Banner's view, expressed in the House of Commons, that 6 per cent. is no longer a fair rate of interest on capital.

PROSPECTING GOLD GRAVEL WITH KEYSTONE DRILLS

During several recent field work seasons the work of prospecting beds of gold-bearing gravels has been carried on in the neighborhood of Barkerville, Cariboo mining division, British Columbia. This work has been undertaken chiefly with the object of determining whether or not the general average gold value of the gravel is sufficient to warrant putting in gold-dredging plant. Last year Mr. J. D. Galloway, assistant mineralogist for British Columbia, investigated mining conditions in Cariboo division, and later his official report was published. The following information, relating to drilling operations, has been taken from his report:

In connection with the drilling operations it would be well to first describe the physical character of the country drilled—viz., Williams creek and Willow river. Williams creek flows through the town of Barkerville in a northerly direction, and a mile below the town it turns to the west and flows into the Willow river. The channel of Williams creek has been fairly well worked out by the old-timers by means of drifting operations. This channel varies from nothing up to 100 ft. in depth, and from the town of Barkerville down, the upper 20 ft. now consists of tailing from old hydraulic workings farther up this and in tributary creeks. The continuation of the channel containing pay-dirt beyond Williams creek is a matter of considerable controversy, as it may have gone down into Willow river, as the water now goes, or it may have swung off into another valley.

The Cariboo Goldfields was a hydraulic enterprise on Williams creek, a mile below Barkerville, which was operated for a time. The greatest difficulty there was obtaining a sufficient grade to carry off the tailing, and to this end a bucket elevator was installed which at first was not a success. After overcoming certain mechanical difficulties, the company unfortunately ceased operations.

Practically all the ground along Williams creek down to and including part of Willow river has been secured by John Hopp and associates. Parts of this were drilled in 1913 by a Mr. Dawson, representing Eastern capitalists. These results were said to have been unsatisfactory, but were not considered conclusive. A more systematic drilling campaign was carried out during the summer and fall of 1914 by J. T. Towers. A cross-section of holes was put down across the Williams creek channel just below Barkerville, another one 3,000 ft. below that, and another 8,000 ft. below. The drill was then moved down to Willow river and a series of holes commenced there. When I visited the district the drill was at the latter place, but operations had been stopped for the winter about that time.

The exact figures which would tell the results of the drilling are, of course, confidential and could not be made public. It may be said, though, that a large area on Williams creek has been partially proved to carry sufficient value to be called first-class dredging ground. The pay value apparently does not extend all the way to Willow river, but the results at Willow river again show pay value, although sufficient drilling has not been done to indicate the extent of the area.

Before describing the actual drilling operations it will be well to consider the important features for the successful operations of a gold-dredge. These may be enumerated as follows:

(1) A sufficiency of gold, in a free state, to pay; this will, of course, vary with conditions.

(2) A soft bed-rock for the dredge-buckets to work on.

(3) A gravel bed which has not too great a depth; at present somewhere about 80 ft. would seem to be the maximum.

(4) A sufficiency of gravel to admit of a large enough amount being earned to pay back both capital and interest of the cost of the necessary plant.

With the exception of No. (4), which is a basic postulate that may be applied to all forms of mining, these conditions may vary within considerable limits, and generally it may be said that the richness of the ground determines whether or not other features not favorable can be overcome. For instance, with a rich deposit it is possible to operate with a deeper cut than on a low-grade deposit. Again, the gold might be contained in a layer of gravel some distance above bed-rock, and in this case the importance of having soft bed-rock would be minimized. The presence of many large boulders in the gravel-deposit adds considerably to the cost a yard of operating; in a deposit containing many boulders, therefore, higher value would be required than in one free from boulders, and vice versa. The amount of gold in the gravel can be closely approximated by careful testing of the ground, generally by drilling.

Along Williams creek and Willow river the bed-rock consists dominantly of soft schists and slates and presents ideal conditions for dredging, as the buckets could easily lift 2 ft. of the rock bottom and thus get all the gold in the crevices. Also, as a rule, the ground is very free from boulders. The depth of ground is the most unfavorable feature of this section for dredging. But there is, nevertheless, a considerable part of the area that is within the dredging limit. Also the depth to which the dredging can be carried is to some extent dependent on the values; that is, if sufficiently rich ground is found dredging could possibly be carried to 100 ft.

The Williams Creek area would require that a large type of dredge be installed; such a dredge could be roughly estimated to cost $500,000 when erected. This may seem high, but it must be remembered that all costs for freight, supplies, and wages are very high in the Barkerville district. Modern dredges are mostly operated by electric power; as there is no electric power in the district, some of the waterfalls would have to be hydro-electrically developed, which would mean a further outlay of capital.

It cannot be said that a sufficient quantity of ground has as yet been proved on Williams creek to warrant the expenditure necessary for a complete dredge-installation, but in the event of a similar area being proved on Willow river the two together might form an attractive dredging proposition. The new electric power plant and dredge would do for both areas; when the dredge had finished at one place it would either be dismantled and moved to the other, or, if any cable was obtainable en route, it would dig out a channel for itself between the two.

The drilling so far done is simply preliminary prospecting, which would be followed later by a complete testing, by putting down holes every 100 ft. In this way the whole ground is mapped out in squares and from the results contour-value maps are made up. The dredge-master then knows the conditions exactly—where the deep ground is and where the values are, etc.

The drilling operations have been carried out under the direct supervision of J. T. Towers, a specialist in drilling engineering, who showed me great courtesy in

explaining and describing the work. The drill used is a large-sized Keystone drill equipped as usual. Some difficulty was experienced in getting suitable pipe, as the ordinary cast-steel pipe crystallizes, under the repeated blows of the hammer, and either breaks off then or later when attempting to remove it. Wrought-iron pipe is the only satisfactory pipe, and to get this it was necessary to send to Pennsylvania; considerable delay was occasioned in freighting this in.

It may be worth while to describe the exact modern method of testing supposed placer-ground by means of a Keystone drill. The machine consists of an upright boiler and engine mounted on a frame running on wheels, and so arranged that the engine operates a hammer or weight up and down a guide on the same principle as a pile-driver. This weight is raised and then dropped by gravity on the butt of the pipe, which is, by the impact, driven into the gravel. The pipe used is 6 in. in diameter in the clear, and is made in 10-ft. lengths. The joints are screwed together, and the upper section screws down until it rests on a flange around the inside of the lower section, the flange thereby taking the impact of the blow and not the screw-threads, which would soon be ruined by repeated hammering. The first length is equipped with a head similarly screwed on, which takes the blow of the descending hammer. When this length is driven down far enough, the head is unscrewed, another length screwed on, and the process repeated. The first section of pipe to be put down has the lower end flared out all round to form a cutting-edge which is 7¼ in. in diameter. This pipe-casing is generally driven down a foot at a time; theoretically, in close-packed gravel, an advance of one foot of the cutting-bit would give 1 ft. 6 in. of gravel in the pipe, but this varies considerably with different kinds of ground. After driving a distance of 1 ft., a bit is put down inside the pipe and the gravel churned up and then extracted by a suction pump. Wherever the drill is passing through ground that is thought to contain gold, the drill is only advanced a foot at a time; but when a layer which is known to be nearly devoid of value is being passed through, then advances of 6 to 8 ft. are made before extracting the core. Invariably, when possible, the pipe-casing is driven ahead and the core extracted after, but if a large boulder is encountered it is necessary to put down a heavy bit and drill through it before the pipe can be driven ahead.

The gravel extracted is run through a rocker and carefully panned, a record for each advance being kept. In extracting the core, care is taken not to remove so much as to go deeper than the end of the bit; as a rule, an inch or two of a gravel cushion is left in the bottom of the hole to ensure that no material shall be drawn in from beyond the periphery of the hole. As the work proceeds exact measurements of the distance driven are recorded at each advance, amount of gravel extracted, and the cushion of gravel left behind. In this way the amount of gravel and value obtained along each section of the hole (whether one foot or more) is ascertained. The value of the gold colors obtained from panning the gravel from each advance (say one foot) is estimated by eye, and then at the finish the total gold from the hole is weighed. It is significant of the accuracy of this eye estimation to say that Mr. Towers showed the writer a log-book of several holes, and in these the total gold in a hole by estimation did not vary from the weighed amount by more than 2 or 3 per cent. When it is considered that the total gravel in a hole of this diameter, 5¾ in. and 100 ft. deep, is just about 1 cu. yd., and that 25 cents a yard would be good-grade dredging-ground, it may be realized with what minute quantities of gold this eye estimation has to deal. The character of the material through which the pipe passes is carefully noted; also the time of drilling, which gives a good indication of the hardness and whether or not the gravel is cemented. In fact, every detail is noted and the log-books show a volume of information which is of great use later on if the ground is dredged.

The drill is generally kept going 24 hours a day, but even if not in operation, a watchman is kept on it to prevent any possibility of "salting" the hole. When a hole is completed—that is, when it is down to bed-rock, or in some cases before that, when the ground is too deep—the casing is withdrawn and the "hole" disappears by filling in. The casing is removed by hammering up against the head instead of downward, and removing a section at a time as it comes up. The pipe is much more liable to break at this stage than in the driving, owing to the unequal strains set up. If the pipe breaks much below the surface, it is generally impossible to recover and has to be abandoned.

In conversation with me, Mr. Towers expressed himself as being well satisfied with the results of the drilling so far done, and seemed very hopeful that the ultimate dredging of large areas of the Barkerville area would be accomplished.

THE ADVANCE IN SILVER.

Boston—An over-night discovery that the stocks of silver in London were far below what had been credited to that centre by the banking interests was the immediate cause of the recent rise in price which has carried the metal across 56 cents an ounce. It was 46 cents only a few weeks ago.

For a considerable time the weekly reports of silver stocks in London did not vary much from £1,500,000. Nobody ever thought of questioning the accuracy of these statistics which were put out by several dealers in silver. Finally, an accounting was made and it was learned to the consternation of all concerned that the actual stocks were but £750,000, an amount far too small for safety, and buying immediately began.

When prices started to move upward it started a general laying in of stocks for coinage requirements and the price advanced to above 56 cents an ounce. One South American country bought 4,000,000 ounces in New York, although it had always before bought its requirements through London. A Scandinavian country took about 1,000,000 ounces. Other buying has been of heavy proportions. But the chief factor has been the buying to fill up silver reserves in London.

China and India use large quantities of silver for coinage, and purchases for those countries invariably affect the market. One of the best posted men on silver in the country who has the marketing of large quantities, sums up the situation as follows: "Silver is the basis for international finance between the Far East and London just as gold is between London and New York. It is probable that fully ten times the amount of silver stored against exchange in these operations would be needed if actual settlements were to be demanded. This in a word indicates the strength of the silver situation. It is not generally known here that dealers in exchange between Europe and the Far East generally buy or sell silver as a hedge against their exchange operations."

THE EVOLUTION OF ORE-DRESSING METHODS*

By Robert H. Richards.

The primitive metal worker picked out the rich specimens by hand and then smelted them. He next washed the ore pile to make the picking easier. He then noticed the small sizes of ore grains collecting in eddies and ripple marks, concentrated by the flowing of the water, and scraped up these. He then ran the mine fines through a trough, and collected the small grains which were left behind. He now found that by putting in riffle blocks he could increase the catch. In this way, the wash trough for ore was developed and finally, at a much later date, the riffle sluice for gold.

The next step in the evolution of ore dressing methods probably came by watching the waste flow away from the tail of the wash trough and build up a sand bank which was rich at the upper end and poor at the lower. From this, he constructed a second or lower trough, from which the building buddle was developed. He found that by sweeping transversely he could greatly aid in keeping the values at the upper end. This combination of a wash trough with riffle cleats and a building buddle is so efficient that it is to-day one of the most valuable prospector's tools, where the prospector is beyond the reach of modern mills and wants an approximate valuation of the concentrating qualities of the ore.

After getting the fixed building sweeping buddle (intermittent) he next made the Frenzoni suspended building buddle (intermittent) with cam spring and bumping post. Then Ellenbecker invented his surface jerking table (continuous) at Calumet and the Gilpin County bumper came next in Colorado. Frue followed with his belt vanner, which is extensively used to-day.

While these improvements were in progress for two-mineral separation, Rittinger invented his continuous side-bump table with the bumping action at right angles to the flow of the water, separating the feed into several products according to weight and size. This was followed by the Wilfley table, which is one of the greatest advances ever made in ore dressing. It depends on the jerking progressive motion acting at right angles to the flow of the water and on the diagonal line of mechanical control of the separation.

The hand sieve for cleaning and handpicking, often used in a wash tub, must have very soon developed the principle of the jig, and next came the mechanical design for the hand jig with moving sieve. It was then arranged with a cam to be run by power. Some designer's mind then said, "we are moving the sieve and letting the water stay still; why don't we move the water and let the sieve stay still," and from that thought came the plunger jig. Then the jig was fed and discharged tailing continuously, the concentrate being skimmed off periodically and the hutch drawn off. Then the discharge for concentrate, with gate and dam, was introduced. This made the jig the entirely continuous machine which is in use to-day in the modern mills. Devices for softening the suction action, which tends to blind the screen, met with favor and have become part of the mill man's equipment. Among them are the floating block, the crank arm, the Collom jig with spring, and the new Century jig with spring.

The Woodbury jig, by a combination of deep bed and gate and dam discharges at graded heights, combines jigging with removal of slime. The pulsator jig overcomes screen blinding entirely and increases the capacity of a jig many times on account of the extremely soft bed it maintains. The Hancock jig of very large size—with moving screen divided off into compartments producing different grades of products, using little water and power, but with very large capacity, 400 tons or 500 tons in 24 hours, ranging in size from 8 mm. to 2 mm.—seems to be the climax in jigging at the present time.

In slime concentration, an early form of table is the Cornish frame, a plane surface, sloping from feed end to tail end, over which slime flows. Periodically, the feed is stopped and the concentrate flushed off. Following this came the convex, revolving, conical, round table which is a continuous-acting machine, feeding, washing, and discharging concentrate and tailing without stopping to discharge concentrate—a most useful table. The fixed blanket table for catching concentrate, and especially gold, was an early development.

In gold working, the canvas table, rectangular in form with a surface of cotton duck, run like a Cornish frame, has been much used. When fed with extremely fine slime, as in the Gates canvas plant, this is at its best, and is a very efficient machine. The Taylor Woodworth experiment at Lake Superior was intended to make the Gates system more automatic with less labor costs, flushing 25 tables, more or less, at once; but for various reasons it was discontinued. The most pronounced success and the utility of the system is the Anaconda rough surface, convex, conical, round table with very slow revolution and fed with extremely fine slime. This has accomplished more and better work than any of its predecessors.

Flotation Process.—Devices depending upon surface tension, or as it is sometimes called, "greasy-flotation," are destined to play an extremely important part in the concentration of ores. They depend upon the great aversion that some minerals (metallic, sulphide and some oxides and carbonates) have to being wetted with water, which is increased by a film of oil on the mineral particle, while others have little or no aversion. The minerals which are difficult to wet with water are easily wetted with oil, even in the presence of water, while those that are easily wetted with water are not easily wetted with oil in presence of water. A little acid increases this differentiation in both directions.

If dry particles of pyrite and quartz 0.01 inch in size are lightly dropped on water, the pyrite particles will almost wholly float on the surface while the quartz particles will almost wholly sink, due in the first place to the greater tension, or resistance of the pyrite to be wetted, and in the second place, to the ease with which the quartz is wetted. If the quartz and pyrite are [illegible] and [illegible] and [illegible] and

be drawn out of the water; air forced into water under pressure effervesces when pressure is removed; water as it begins to boil liberates fine bubbles of air. If oil is used in larger quantity, it floats up the sulphide by its buoyancy.

If quartz blende and galena are treated as above, the blende and galena will be found in the scum or froth; but if they be given a brief roast beforehand, the galena with slight coat of oxide will sink with the quartz and the blende will float in the scum. The galena can then be separated from the quartz by the concentrating tables.

If fine magnetic sand be mixed with the ore while the oil is being stirred in, the magnetite forms a catching nucleus for the ore, and the scum so formed can have the oil removed, to be used over again, and then the magnetite can be separated by magnet from the values.

The pneumatic riffle table (Sutton, Steele and Steele) avoids the use of water in concentrating ores where water is scarce.

The Plumb air jig is proving a valuable helper in separating certain concentrate products where the wet machines do not give perfect enough separation, for example, blende from galena.

The Magnet.—There are three leading conditions, and consequent processes, whereby the magnet may be used for separating the mineral grains that are attracted from those that are not. (a) Minerals that are strongly magnetic (b) minerals that are weakly magnetic, and (c) minerals that are not magnetic but may become so by suitable treatment.

(a) Strongly-magnetic minerals may be separated from others, whether or not of the same specific gravity. Many magnetic machines have been devised; perhaps none has more capacity or is more efficient than the Ball-Norton belt machine. This, by its numerous magnetic poles of alternate polarity—the earlier of stronger magnetic force, the latter of weaker—will separate, first, a tailing of no commercial value, next, a middling for re-crushing and re-treatment, and, finally, a concentrate for the furnaces. This concentrate is made especially free from the non-magnetic minerals owing to the alternate polarity of the poles, which causes the tufts of mineral grains to be inverted with every new pole, and thus the less magnetic or non-magnetic grains are sifted out from their entanglements.

(b) For weakly-magnetic minerals, a number of high-power magnetic machines have been devised, among them perhaps none has more efficiency than the Rowand-Wetherill magnet. These magnets can separate minerals that have so little magnetic susceptibility that they show none of it to a strong, permanent hand magnet. For example, limonite may be completely separated from quartz. Again, monazite may be completely separated from garnet and hypersthene (more magnetic minerals) and from zircon and quartz (less magnetic minerals).

Differential Magnetic Work on Weakly Magnetic Minerals.—A little 6-inch Wetherill magnet (Rowand type) at Portland, Oregon, separated black sand by repeating the treatment each time with increased amperage, the minerals taken out were as follows: With 0.2 amperes electric current the magnetite was taken out; 1.1 amperes took out the ilmenite; 1.6 amperes, the chromite and platinum; 1.75 amperes, the garnet; 2.2 amperes, the hypersthene and olivene; 3.5 amperes, the monazite; leaving zircon and quartz, gold and iridium as non-magnetic.

(c) The separation of dark-colored blende from pyrite is generally in class (b), the blende being the weakly-magnetic mineral, but with resinous, light-colored blende (commercially non-magnetic), the process is more complicated. The pyrite is coated on its surface with a thin film of magnetite or pyrrhotite by a brief oxidizing roast; the product so prepared easily yields to the treatment described in class (a). A 1 mm. grain of pyrite exposed between one and two minutes to oxidation at a red heat reaches maximum magnetic properties; with longer time or shorter time, it has less magnetism.

In separating siderite from resinous blende, the procedure is as with light-colored (non-magnetic) blende, where the roasted siderite is the magnetic mineral only. The exposure required in the furnace is to a higher heat and for a longer time than with pyrite.

Static electricity from a frictional machine effects a separation on certain minerals of the same, or nearly the same, specific gravity. If a conductor, for example, a brass cylinder, is charged with one pole of a static machine and grains of sand of mixed minerals are dropped on to it, the good conductors will at first stick tight to the cylinder, but as soon as fully charged, will fly off into space. The poorer conductors do the same, but it takes them a longer time. The current from a dynamo will do the same, provided its voltage is sufficiently high. An alternating current has a special advantage in that it gives three products: (1) very good conductors, which fly off immediately; (2) a middling, which does not get sufficiently charged before the current is reversed, and so sticks to the pole (they have to be brushed off the pole); and (3) the very poor conductors, which simply tumble off the cylinder as it slowly revolves.

Breaking.—Very early in the scheme of concentration the use of the hand hammer for cleaning the values from the waste came in. This was followed later by hammers driven by power, or crude stamps. These were gradually developed until the California stamp was evolved.

Gravity stamps are common, weighing 1,000 lbs. to 1,200 lbs. or even 2,000 lbs., crushing down to ¼ inch maximum and to 1-30 inch minimum. A recent design has a cam with uniformly accelerated motion which saves some power and most of the noise.

The rock breakers of the Blake type were introduced to do away with the heavy work of coarse breaking by hand.

Rock Breakers of the Blake type are standard for milling work. They are made up to 24 inches by 36 inches jaw opening. One firm makes one much larger than that. The larger sizes break to 4 inch, the smaller to 1½ inch in size.

The Dodge breaker is used in places where a constant maximum limit in size is especially important. They break down to 2 inch or even 1 inch.

The Gates and McCully spindle breakers are used for taking the run of mine and bringing it down to some uniform maximum size; 4-inch size is common for the large machines. The smaller machines crush to 2 inches or 1½ inches.

Rolls are standard for intermediate breakers. They are made as large as 54 inches by 18 inches for the greatest capacity and efficiency. Belted rolls are much more common than geared rolls. They break to a maximum of about 1 inch and to a minimum of about 1-16 inch.

Chile mills and tube mills, cylindrical or conical, are prominent machines for fine crushing preparatory to concentration. Their breaking limits range from 1-16 inch, or 1½ mm., maximum, down to 1-50 inch., or ½ mm. minimum size; tube mills are universal for the finer sizes. In some cases, the tube mills are required to break much finer. The finest limit may be 0.08 mm., or 3-1000 inch.

Steam stamps weigh up to 2¾ tons and usually crush conglomerate at the rate of 300 tons per 24 hours from 3-inch down to 3-16-inch, and amygdaloid at the rate of 600 tons per 24 hours, from 3-inch down to ⅝-inch.

Improvements in Milling.—In the Lake Superior copper region, the improvements that have done the most to reduce waste and increase yield are: (1) the mortar discharge, which removes copper nuggets from the steam-stamp mortar almost as soon as they are freed from rock. Formerly these nuggets remained in the mortar and were abraded, yielding much fine copper slime—too fine to be saved. (2) The use of a coarse stamp discharge screen, ⅝-inch round hole and a trommel ¼-inch hole, giving a chance to catch ⅝-inch to ¼ inch nuggets or an outside jig or hydraulic classifier and saving much sliming of copper. The ⅝ to ¼-inch jig tailing is re-crushed and put back into the system. (3) The re-crushing and washing of all coarse tailing for the recovery of included grains of copper.

At Anaconda, Montana, the latest flow sheet shows that the rock will be crushed primarily to 7 mm. and then screened on a 1½ mm. screen, the oversize yields concentrate on Hancock Jig and the middling is re-crushed to 1½ mm. The primary and re-crushed (1½ mm. to 0) materials go to an Anaconda classifier, yielding slime (.08 to 0 mm.) for flotation and sand for Wilfley tables. The middling from these (no tailing is made) goes to tube mills and Anaconda classifiers, making slime (.08 to 0 mm.) for flotation and the sand returns to the tube mills. The primary flotation will yield two products, low grade concentrate and tailing with .08% copper. The primary concentrate will go to secondary flotation and yield high grade concentrate and middling. This last will go back over again to the primary flotation. The yield of a final tailing with only 0.08% copper is a most extraordinary achievement.

The improvements in Missouri Lead, Idaho Lead and Arizona Copper are along the same general lines as Montana, namely, jigs for coarse sands, classifiers and tables for finer sands, and flotation for the slime. The limit at which re-crushing stops is much coarser in the lead and silver-lead mills than in the copper mills, owing to the lower value of the chief metal value.

The importance of classification preparatory to Wilfley table work seems to be everywhere admitted, by it the fine free mineral losses in Wilfley table tailing are mostly prevented.

The porphyry coppers of Utah and Arizona generally use a roughing Wilfley table, the tailing from this goes to classifiers and the various products to separate corrugated belt for the coarser sizes and the smooth belt for the finer. Flotation has been taken up and is to increase the saving on the older method very greatly. The wonderful success of the porphyry copper mines seems to have been due to the creation of enormous capacity, even if high saving was not at first attained. Now the high saving is coming through the flotation process.

The Timber Butte mill of Butte, Montana, gives a very good example of the most advanced methods used on complex ore, combining water concentration and flotation. The ore, carrying zinc, lead, copper, gold and silver, is crushed to 2½ mm. Roughing tables then give (1) mixed minerals, (2) coarse zinc and (3) slime. The mixed minerals (1) by classifiers, jigs and tables give (A) lead, (B) mixed minerals and (C) coarse zinc. The mixed minerals (B) are re-crushed to 20 mesh (probably ¾ mm.), then classifiers, and tables give (a) lead, (b) mixed minerals, (c) coarse zinc, and (d) slime. The mixed minerals (b) are re-crushed to 60 mesh (probably ¼ mm.), and all the slime added to them. Flotation separates the (1) zinc and lead from the silica and insolubles. Then wet concentration upon the flotation zinc and lead gives (1) lead and (2) fine zinc, yielding a high extraction of zinc, lead and copper. The silver and gold are distributed in with these other metals.

METALS AND MUNITIONS.

Copper, zinc, aluminum, nickel, and other metals being of such enormous importance in the production of munitions it is not surprising to learn that the Institute of Metals (which takes within its purview all metals except iron and steel), is very closely concerned with the production of the thousand and one metal articles required for the successful prosecution of the war. The Institute is in daily touch with many of the munition factories throughout Great Britain, and also with certain Government Departments requiring metallurgical information. As an indication of the utility of the publications of the Institute of Metals (particularly at the present time) it may be mentioned that large shipments of the Journal of the Institute of Metals, in which are recorded the very latest scientific methods of dealing with the non-ferrous metals, are being despatched to Japan and the United States for use in works engaged in producing munitions for the allies. In addition, volumes are being sent to various public and university libraries located in the United States' munition centres. German submarines have taken toll of large consignments which were sunk in the Hesperian and the Arabic, but duplicate sets of volumes have now replaced those lost in this manner. The volumes are supplied gratuitously to members—numbered among whom are most of our copper and munition makers—but copies can be purchased by non-members from the office of the Institute of Metals, Caxton House, Westminster.

TOUGH-OAKES' DIVIDEND

Cobalt, Dec. 4.—A second dividend of 12½ cents a share, the rate of 10 per cent. per annum, has been declared to the Tough-Oakes Gold Mines. The par value of the stock is $5 a share. The second dividend, just declared, is payable January 3, 1916. This makes a total of [illegible] cents a share from Tough-Oakes since it went on a dividend basis. The dividend record is as follows:

[illegible]

GLEN LAKE MINING CO.

Cobalt, Dec. 4.—A [illegible] shipment of high-grade ore was made from the Foster mine last week by the Glen Lake Mining Company, lessees of the Foster. The ore was taken from extensions of the Lawson vein running into Foster territory. This pocket or ore was exposed for some time, but was left in the mine [illegible] the price of silver advanced.

A RACE WITH STARVATION

By J. Harmon Patterson.

We left the sound of the locomotive whistle about the middle of March, bound for Clear Lake, about sixty miles distant as the crow flies, on a prospecting trip. It was Bill Bateman's maiden trip, but he knew how to handle a paddle with the best, and this counted for much. He was strong, willing and cheerful withal, good in an argument and a good listener, which qualities tend to make the ideal companion, when you are cut off from the rest of the world for months at a time. Then I had as guide Indian Charlie, one of the few Indians I ever knew on whom I could absolutely depend. He had been in the country to which we were going and knew it well.

We took in with us five hundred pounds of supplies. This we supplemented by much moose meat purchased from an Indian trapper. It was our plan to explore the country as well as possible before the break-up, so that we would have definite information when real prospecting would be possible. I was employed this season by a syndicate who trusted to my judgment in choosing territory, and I was very anxious to make good if possible.

Indian Charlie brought in our canoe as far as Otter Lake and it was our intention to move camp to that point before the streams would open, having our supplies in cache at Clear Lake.

It was late in April when we arrived at Otter Lake, having been delayed rather long, and consequently we did not bring with us as much provisions as previously intended. We proposed making a round trip, making a preliminary examination of the country, and arriving back at Clear Lake on the last of our supplies. Then would begin the more detailed examination of the country we had laid out.

We set out from Otter Lake on the third of May. The stream we followed was not used by the Indians. It was very rough and very crooked, and where we could not let the canoe down a rapid by the lines we had to cut out our portages. As the snow was yet deep in places, we had to use snow-shoes.

The next stream was also very swift, and if possible more crooked than the last. It flowed into a much larger river, up which we went against a swift current which made progress very slow. This river we left on the fourth day for a small creek and for two days we fought our way up its tortuous course.

Then our misfortunes began. While making camp at night on a rough and rocky portage Bill drove the axe deep into the side of his foot. We hastily took off his shoe-pack and sock, and as the blood spurted out in great gushes I saw that the artery was severed. By the aid of a rough tourniquet I checked the flow of blood, but what to do next I did not know. Charlie suggested flour. We plastered it on the wound and bound it up with cloth, then more flour and more cloth. Taking off the tourniquet the blood did not show. We then laid Bill on his back and slung his foot above the ground by a line from the tent pole.

Next day we took stock of our provisions. We only had enough to last about four days. Bill suggested that we start at once for the cache while we had something to eat, but this was obviously impossible as he might bleed to death. Charlie said that we must stay till we were sure that the foot was all right. In the meantime he would hunt for game. If there were rabbits it would be all right, but if there were none all we could hope for would be squirrels, partridge, muskrat, and perhaps a porcupine. Charlie proceeded at once to make a bow and some arrows, and I was greatly surprised at his accuracy with this crude weapon.

We hunted early and late but our total bag of game for five days was eleven red squirrels, five partridge, three muskrats and one porcupine.

We were in an awkward predicament. Bill's foot was still in danger, but it seemed to be healing nicely. We decided that we must make a trip to the cache and return for Bill. We could not expect to return from our cache in less than five days and we did not have two days' provisions for one man. All that we could leave was about half a pound of pork, a good handful of flour and a dozen squares of condensed soup. For ourselves, though we took plenty of tea, we had to depend on game which we would see along the shore or on the portages. To secure this we must depend on a very crude weapon.

Had we been well fed before starting it would not have been so serious but for two days we had been on less than half rations, and the trip would be a hard one.

Next morning early we set out for the cache. We left Bill with plenty of wood. There was good water a few feet from the door of the tent. We took a pair of blankets, a rubber sheet, an axe, a small tin pot, our snowshoes and the bow and arrows. We quickly passed through Beaver Lake, and portaged into the creek again. We made two portages of about half a mile each, then a small lake. The stream above this lake was very narrow, very swift and very crooked. We came to a rapid and thought we could paddle up, but found it too swift. The shores were perpendicular rock, so we began to let the canoe back. How it happened I do not know, but in a twinkling I was in the water and being whirled down in the current. I thought of Bill, of his waiting and watching for our return while he slowly starved to death, and I saw him at last dead in the tent terribly thin and white. All the energies of body and mind were bent on finding a footing in the rushing, boiling water. After what seemed an age I managed to secure a hold on a rock and from it I worked my way into shallow water. Down below I saw Charlie. He was clinging to the canoe and soon reached the shore. We found the paddles, bow and arrows and snowshoes, but there was no sign of the pack. We mourned most our blankets and tea, but it was no use turning back, so we made a portage and went on.

We fought our way up that stream and late in the afternoon came to the lake. A plainly marked portage showed and we took it without hesitation. Some of it was bare, but in places snow was deep. It was a good mile long and before we reached the other side it began to rain. The lake we saw in the gathering darkness was long and narrow. We made a cheerless camp on the shore, collected all the wood we could find and made a fire. Then we leaned the canoe up into a tree so that we could stand under it. Hungry, weary, wet and cold we stood or walked around the fire. Oh, for a dish of hot tea! We had not seen a living thing all day and I began to despair of our reaching the cache. Charlie inquired how many holes in my belt. I said "About six." "Maybe that will do," he replied. He never complained once.

At the first sign of dawn we tried the lake. The ice was rotten and would not hold us. We secured two long dead tamarac poles and placed one on each side of the canoe. Then with one foot in the canoe and the other on the pole we drew the canoe to the end of the pole, which we then pushed ahead. After half an hour of this work we found the ice strong enough to bear us and we were nearly across before it became necessary to use the poles again. Along the shore was an open channel, which we followed, looking for the portage and occasionally drawing the canoe over a point of ice. At the extreme south end of the lake we found the portage, and as we came to it Charlie spied a muskrat. Up went his bow. I held my breath. His arrow found the mark and in another minute we had the animal. While I made a fire Charlie skinned our prize. It was then quickly grilled and divided. It was not a very delicious morsel, and not well cooked, but it seemed to put new life into me. We saved the skin and bones, in fact nothing was wasted.

The next portage was very short and the lake itself was much like the last. We worked around the south end as there was considerable open water near the shore. The next portage of three hundred yards let us into another small lake which to our great delight was clear of ice. We soon crossed it and camped on the portage. There was a perpendicular wall of rock some twenty feet in height. In front of this Charlie made up a good fire and the heat reflected from the rock kept us quite warm. Between dozing, sleeping and making up the fire we put in the night.

It was still dark as we packed the canoe over this portage which opened into a deep bay. Coming out of this into a large lake clear of ice, I looked around me. It had a familiar appearance. Yes, it was Brule Lake. One more portage to Clear Lake and plenty to eat. Drawing up my belt a couple of holes I paddled hard and we soon reached the portage. Charlie explained that on shallow lakes the ice melted much earlier than on those which were deep, as the water would be much colder in the latter. He said that we might expect to take the canoe up Clear Lake as far as the point.

We succeeded in paddling up the stream for about a mile on this portage but when I got out of the canoe I was so dizzy that I could hardly stand. Charlie picked up the canoe and went on as though nothing was the matter. It was all I could do to follow. He put down the canoe at the edge of a small pond and as I came up I saw him sieze his bow, fit an arrow and take careful aim. Then I watched the flight of the arrow. He dropped the bow, ran forward and picked up something. I sat on a log sick and dizzy. Another muskrat and just in time. It was soon cooked and eaten. How quickly I seemed to enjoy, although at first it made me sick. "Guess we are good for the cache now," said Charlie.

"Clear Lake and no ice in sight. What will be first?" I asked.

"Fire, tea, milk, pork, make bread, cook beans," was the reply.

At this point we found the lake covered with rotten ice. Away across on the far shore I could see our camp. Plenty to eat there, but we must take a six mile walk around. We climbed steep, rocky hills, and waded icy swamps with the water to our waists. At times we were compelled to use our snowshoes. Charlie in the lead, we wandered on. Once after wading a swamp he had to make a fire, as I was completely numbed by the cold. At last we reached the bay behind the cache. Charlie waded out till he found the ice would carry him. With a stick he tested it as he went along. When he was half way over I followed. We reached the shore in safety and climbed the hill.

The cache was as we had left it. Quickly Charlie opened one end and brought out a chunk of pork. With a knife he cut off a slice and began to devour it raw. I told him he would be sick, but he paid no attention.

I tried some soda biscuits, but could not swallow them. A couple of handfuls of sugar went better. A can of St. Charles Cream was the next item. Charlie left the pork for the cream. Then we set up the stove and soon had hot tea. It seemed to act on every tired nerve and fibre in me.

We soon had pork cooking in a pan and beans in a pot, but this was too slow. I was asked to build another fire so that he could make bread and boil some rice. I ate a good meal but from the amount of provisions which Charlie demolished, I was sure he would be ill. He said, "Lots of meals I missed." I am quite sure that in two days he brought the average up to the normal.

We arranged some tar paper as a screen in front of the fire. I spread an old coat on the brush and tried to sleep, but I was often awakened by the cold as the night was frosty. Then Charlie would shake me. "Eat something?" was always his question. "Let me sleep if I can," I told him once. "Can't go far on sleep," was his answer. "Eat plenty grub, make fast trip back, then sleep," all of which I did.

As soon as it was light we made up our packs. The guide had about seventy pounds, I about thirty. We had now an axe, a tin pail, frying pan, and dishes. We took plenty of pork, flour, tea, sugar, beans, rice, milk and other supplies. The trip to the canoe was hard, but we went further inland and missed most of the swamps.

Charlie thought it advisable to stay at our last camp by the rock. We could have travelled further, but this would be so much more comfortable. He cut a large quantity of wood and made two fires. We also had a good brush bed. I slept fairly well, but woke up very stiff and cold. It was four o'clock, so we made a good breakfast and set out. On our way along the shore we saw a muskrat swimming in front of us. "Want him?" asked Charlie. I declined. What a God-send he would have been on the other trip.

We travelled fast and made our camp that night on the shore of Sog-a-jew-a-wig-a-mog Lake, but did not sleep. It was too cold, and at break of day we launched our canoe for the camp. This stream which had been so hard to paddle against now hurried us along and by noon we made the portage into Beaver Lake. Charlie gave a war-whoop which would carry about a mile. Immediately we heard a shout, so we knew that Bill was alive, and very glad he was indeed to see us. His foot, too, was steadily improving.

After lunch I took off my clothes and crawled into bed. I remember in a vague way of someone rolling me over, but when I awoke it was broad day.

The Cambria Steel Co., Lackawanna Steel Co., Newport News Shipbuilding Co., Youngstown Steel & Tube Co. and other inland or Trenton plants near Chicago are to be merged within next few days if plans do not miscarry, according to J. Leonard Replogle, head of syndicate which purchased 240,000 shares of Cambria Steel Co. held by Pennsylvania Railroad Co. The consummation of the merger will depend upon capitalists obtaining control of 100,000 more shares of Cambria.

PERSONAL AND GENERAL

Mr. Robert Livermore, manager of the Kerr Lake Mining Co., is examining the Smith La Bine claims at Sesekinika, Ont.

Mr. Frank Horne of the Dome staff is in charge of the installation of a small plant at the McDonough property in Pacaud township, now being opened up by Mr. Geo. Miller.

Mr. Wasaku Kondo of Tokio, Japan, has been visiting cyanide plants at Cobalt.

Mr. David Sloan, manager of the New Ray mine, has returned to Porcupine from the West.

Mr. A. H. Brown is at the Dome Lake mine.

Lieut. Thorne, formerly manager of the Trethewey mine, who has been recruiting in the mining districts for No. 1 Tunneling Company, is now at Pembroke, Ont.

Mr. John L. Baker, who was in charge of construction of the Tough-Oakes mill at Kirkland Lake, is now on the staff of Moose Mountain Ltd., investigating at Brooklyn methods of treating the Moose Mountain iron ores.

Mr. L. K. Armstrong of Spokane, Washington, has been re-elected secretary-treasurer of the Columbia Section of the American Institute of Mining Engineers, the territory covered by which includes Eastern Washington, Western Idaho, and parts of Oregon and Southern British Columbia.

Mr. Chas. A. Banks, general manager for the Jewel-Denero Mines, Ltd., who left the Boundary district of British Columbia on November 9 for New York, sailed from that city on November 21 by the steamer Philadelphia for England.

Mr. W. M. Brewer has returned to Victoria after having spent the summer and autumn investigating mining conditions in parts of Similkameen and Yale districts of British Columbia, on which he is now preparing a report to be made to the Provincial Department of Mines.

Mr. A. N. Cantril, general manager of the Coalmont Colliery, in the Granite Creek-Tulameen region of Similkameen district of British Columbia, is at Coalmont awaiting the completion of arrangements for a resumption of development work in the coal-mine owned by his principals.

Mr. C. L. Copp, formerly manager of the Coronation gold mine, on Cadwallader creek, Lillooet district of British Columbia, is now manager of the Pioneer mine, situated in the same neighborhood.

Mr. Smith Curtis, at one time interested in copper properties in the Boundary and Similkameen districts of British Columbia but recently giving his attention to mining properties in Ymir and Sheep Creek regions of Nelson mining division, was in Victoria recently, endeavoring to secure capital for mining development.

Mr. A. F. Eastman, of Tacoma, Washington, secretary of the Tacoma Steel Co., owning the Marble Bay mine on Texada Island, B. C., has been on a visit to San Francisco, California.

Mr. Stanley A. Easton, of Kellogg, Coeur d'Alene district of Idaho, general manager for the Bunker Hill & Sullivan Mining Co., who was last month elected chairman of the Columbia Section of the American Institute of Mining Engineers for the ensuing year, was years ago manager of the Gold Drop mine, near Phoenix, B.C., then owned by Montreal men but afterward sold to the Granby Consolidated Co., which has since taken out of that property and the adjoining Monarch mine about 1,500,000 tons of copper ore. Mr. Frederic Keffer, now of Spokane, Washington, who was elected vice-chairman of the Section, was the first general manager for the British Columbia Copper Co., and developed that company's Mother Lode mine near Greenwood, Boundary district, from a mere prospect to a big copper mine.

Mr. W. J. Elmendorf, of Seattle, Washington, for several years in charge of important mining development in Portland Canal mining division, British Columbia, was a passenger on the Canadian Pacific steamer Princess Maquinna when three or four weeks ago she vainly attempted under dangerous conditions to rescue the officers and crew of a Chilean full-rigged ship that during a most violent storm was wrecked on the south-west coast of Vancouver Island.

Mr. Geo. L. Fraser, at one time managing a coal mine in South-west Alberta, is now with the Granby Consolidated Co. at its big copper mines at Phoenix, Boundary district of British Columbia.

Mr. A. I. Goodell, who was manager of the copper smeltery at Boundary Falls, B.C., during several of its operating years, and afterwards superintendent of the Le Roi Mining Co.'s smelting works at Northport, Washington, was at Seattle and other places in Washington last month obtaining information that will be considered in determining the site of the smelting works to be established for the Bunker Hill & Sullivan Mining Co. Mr. Jules Labarthe, who prior to becoming general manager for the Mason Valley Co. was superintendent of the Consolidated Mining and Smelting Co.'s works at Trail, B.C., has been looking into the engineering side of this projected new enterprise.

Mr. Thomas Graham of Victoria, chief inspector of mines for British Columbia, went to Ravensdale, Washington, last month, where there had been a coal-mine disaster that resulted in the loss of 31 lives. Among other officials who also investigated conditions after the explosion there were Mr. H. M. Wolflin of San Francisco, engineer for the Industrial Accident Commission of California, and Mr. Edwin Higgins, of Pittsburgh, Pa., of the staff of the United States Bureau of Mines.

Mr. J. Cleveland Haas, of Spokane, Washington, last month visited mining properties on Vancouver Island and on the mainland of British Columbia in Vancouver mining division.

Mr. R. W. M. Hunter left Victoria, B. C., at the beginning of December to proceed to Montreal, Quebec. Before making Victoria his headquarters, Mr. Hunter was engaged in mining development in the neighborhood of Nelson, in the same province.

Mr. E. Jacobs returned to Victoria at the end of November after an absence of seven weeks, during which period he visited mining camps in East and West Kootenay, Boundary, and Similkameen districts of British Columbia, and afterward spent a few days each in the Coeur d'Alene district of Idaho and at the State College of Washington, Pullman. Among many other mining men he met during his tour were Mr. Douglas C. Livingston, whose first mining connection was on Vancouver Island, and Mr. Francis A. Thomson, whose school days were spent in Victoria. Professor Livingston is now head of the mining engineering department of the University of Idaho, Moscow, Idaho, while Professor Thomson is at the head of the important mining

engineering department of the State College of Washington, where really excellent educational work is being done on an extensive scale.

Mr. A. W. Jenks, of Berkeley, California, has been examining the Carmi mine, situated 50 to 60 miles west of Greenwood, along the Kettle Valley railway between Midway and Penticton.

Mr. Frederic Keffer has been examining the condition of the British Columbia Portland Cement Co.'s cement manufacturing plant near Princeton, Similkameen, B.C., and its shale and limestone deposits in the neighborhood of the works and elsewhere in the district, in the interests of the bondholders, who are endeavoring to arrange for a resumption of [illegible] ing.

Mr. R. A. Lambert has returned to his home in Vancouver, B.C., after having done another season's work at the Golden Gate Syndicate's placer-gold property on Granite creek, a tributary of Tulameen river.

Mr. Douglas Lay, who went to England last spring from the Slocan district of British Columbia after the closing of the Van-Roi mine, of which he had been superintendent for several years, expects to soon obtain a commission in the British army, for active service in the European war.

Mr. Ernest Levy, of Rossland, B.C., manager of the mines of the Le Roi No. 2, Ltd., was an invited guest at the meeting of the Columbia Section of the American Institute of Mining Engineers held at Wallace, Idaho, on November 19-20, and joined in an excursion to the Consolidated Interstate-Callahan Co.'s famous zinc mine and to several concentrating mills at which flotation machines are in successful operation.

Mr. W. R. Rust, of Tacoma, Washington, is reported in Tacoma and Seattle daily newspapers to have severed his connection with the American Smelting and Refining Co. and resigned from the presidency of the Tacoma Smelting Co. The resignation is to become effective on January 1, prox. The press despatch says that no reasons are assigned except a desire on Mr. Rust's part to devote his time to the management of personal properties, including gold and copper mines in Alaska, and of the Tacoma Exploration Co., of which he is president. Mr. Rust was one of the pioneers of Alaska development. He built the Tacoma smelter in 1890. About 1900 he joined forces with the Guggenheims, selling them the smelting works and afterwards leading their invasion of Alaska.

Mr. Roy Wethered, who, following his leaving the employ of the Consolidated Mining and Smelting Co. at one of its mines at Ainsworth, B.C., was in Spokane, Washington, for some time, is now with one of the mining companies operating in the neighborhood of Wallace, Idaho.

Mr. W. R. Hill, of the Capella, a mining property situated near New Denver, B.C., is spending the winter season in Ontario.

Mr. Hugh M. Wolfflin, who was in charge of the United States Bureau of Mines' mine-rescue station on the campus of the University of Washington, Seattle, Washington, at the time several British Columbia mine inspectors took the regulation mine-rescue training course there, is to be transferred from San Francisco, California, to the Bureau's chief station at Pittsburg, Pennsylvania. Mr. Edwin Higgins, also of the Bureau's staff, is stated to have been selected to succeed Mr. Wolfflin as engineer to the California Industrial Accident Commission, without, however, severing his official connection with the Bureau. Both officials are experienced and zealous workers in connection with accident prevention and mine-rescue training.

Mr. Justin S. DeLury, lecturer in geology, University of Manitoba, is expected in Toronto next week.

Mr. B. E. Cartwright is in Toronto.

Mr. S. W. Cohen has been appointed manager of Croesus Gold Mines, Ltd., whose property, the Dobie-Leyson, in Munro township, is now being developed.

Mr. J. R. L. Starr has been elected president of McKinley-Darragh-Savage Mines of Cobalt, Ltd., succeeding Mr. Justice Masten.

OBITUARY

William Andrew Conner, of Plainfield, N.J., died suddenly Monday, December 6th, at his office in Perth Amboy, N.J. He was born in Baltimore, September 12th, 1859. He began his business career in 1876, in Pittsburg, in the oil refining business, in which he reached the position of assistant manager for the Standard Oil Co. In 1885 he took charge of the first plant built by the Standard Underground Cable Co. of Canada, Limited, in Hamilton, Canada, and from then to the time of his death he was the head of the manufacturing business of that company, including large plants planned and built by him in Pittsburgh, Pa.; Perth Amboy, N.J.; Oakland, Cal.; and Hamilton, Canada. He was a director for 10 years and first vice-president since 1909. He was vice-president of the Perth Amboy Trust Co., in whose inception he had an active part. He has resided in Plainfield since 1904. He leaves his widow, who was Miss Tupper, of Michigan; a brother, Edward Conner, of Orange, N.J., and a sister, Mrs. Roake, of Brooklyn, N.Y. He was a cousin of Mr. O. T. Waring, of the Standard Oil Co., Mr. E. J. Waring, of the Standard Underground Cable Co. and the late Richard S. Waring.

DOME MINES, LTD.

Along with their quarterly dividend checks this month Dome Mines shareholders received a condensed statement of the result of operations for the half year to September 30, as follows:

Earnings—From monthly reports of gold received, $[illegible] recovered from semi-annual mill clean-up, $60,184; non-operating earnings, $7,745; total, $800,360. Less operating and development costs, $366,458; net earnings, $433,902.

The dividend charge on Dome is $[illegible] annually, while the above net shows $867,000 annually.

The balance sheet shows the company [illegible] cash in bank. Included in the assets are cash in bank, [illegible] general fund, $111,199; cash in bank fund for special development and improvements (this being the balance of the money realized from the recent issue of 50,000 shares, $400,058); cash in bank, semi-annual mill clean-up, $60,184; gold bullion in transit, $98,575; and accounts receivable, $6,417.

The only active liabilities [illegible] pay-roll, $26,453 accounts payable, and $5,729 accrued taxes.

The surplus for the current year to date, after allowing $60,000 for depreciation of plant, is shown at $573,902, which, added to $663,598, the surplus from the last fiscal year, makes a total of $1,037,501, from which the $[illegible] paid in dividends September 1 is deducted, leaving a final balance of $837,500.

On the basis of increased tonnage and improved values in the last half of the year, a profit and loss surplus in the next statement of well over $1,000,000 is indicated.

BETHLEHEM STEEL.

New York—It is estimated that Bethlehem Steel Corporation is now shipping at the rate of more than 20,000 complete shrapnel shells daily, a new high record.

By the first of next year it would not be surprising if shipments were at the rate of 25,000 shells a day, or 7,500,000 a year.

With additional machinery and plants, and increased efficiency, a production of 10,000,000 shells in 1916 is not out of the question. It is on this expected output that certain steel manufacturers base their estimates of earnings for next year.

Estimates of Bethlehem Steel's earnings in 1916 range between $300 a share and $500 a share on the common. If the latter figure is reached, it would mean over $600 a share for the common in 1915 and 1916, as it has already been established that net earnings for the current year will be in excess of $100.

Since the middle of the current year there has been a remarkable reduction in cost of producing shells by the Bethlehem Co., which means so much additional profit.

Production has increased each day and there is no telling how large the output will be before the European war ends. It seems certain, however, that earnings on war orders are going to run far in excess of the present market value of the common stock. This is the main reason why Charles M. Schwab and well informed banking interests have invested their money in Bethlehem Steel common. It is figured that these enormous profits will accrue to their benefit in one way or another. If the money is not all disbursed to shareholders, the latter will have their equity in the surplus accumulated or in new plants and acquisitions.

Assuming that no dividends are paid on the common stock in 1916, Bethlehem will have accumulated a surplus in two years that would permit construction of steel plants almost as large as those at Gary.

It is well understood that Schwab has planned an outlay of $25,000,000 for new construction, to be made up largely of plants designed for manufacture of commercial steel. An expenditure as large as this would still leave a surplus for 1915 and 1916 in excess of $50,000,000 after liberal charges for depreciation, and it is fair to assume that some sort of a distribution will be made to common shareholders. Whether this will be in the form of a large cash dividend, a stock dividend or both, is a matter to be determined by Mr. Schwab.

Charles M. Schwab's methods are not selfish, and the shareholders of Bethlehem are confident of fair treatment. With most of his war contracts yet to be executed, Mr. Schwab is giving little attention to the question of a capital readjustment or dividends. This is a subject that will be given serious and thorough consideration later on. It may come up when the directors meet early next year to act on preferred dividends.

CONSOLIDATED MINING AND SMELTING CO. OF CANADA, LIMITED.

Consolidated Mining and Smelting Co. stock was listed on the Toronto Stock Exchange on November 12. As it has been one of the favorite securities on the market, this move has been expected for some time.

The announcement was made to the Exchange authorities that a new issue of stock had been made amounting to 11,611 shares of treasury stock. On November 12 the shareholders were mailed the right to take this stock at par in the proportion of one new share for every five held by them. The new issue leaves $533,700 of the $7,500,000 authorized capital still in the treasury. This new distribution acts as a small bonus to shareholders, because on the current market value of the stock they will profit by the rights by between $7 and $8 a share. The purpose of the new issue has not been disclosed, but the proceeds will probably be devoted to equipment for recovering zinc.

The company, which has been working out a new process for treating zinc ores, has, it is stated, demonstrated that it can successfully recover the zinc. As a result the huge quantity of zinc ore that has been accumulating for a long time will now be treated. This will add greatly to the assets of the company.

The complete figures of the company's last fiscal year's operations have, it is understood, been passed on by the directors, and were fully up to expectations. The annual meeting has been called for the third week in December; the annual report will not be available until that time.

INSTITUTIONS AND THE WAR.

In the cases of certain of the technical institutions the membership figures show no increase since the war, the reason being that these institutions and their members are not particularly associated with war-work. Members, therefore, in such cases, join the fighting forces in large numbers as the best way of serving their country. Though about ten per cent. of the Institute of Metals membership has been temporarily lost in this way most of the members are now assisting the country by working "on munitions." The war activity in the metal industries is such as to tend strongly to reinforce the membership of the Institute. It is probably due to their desire to see and to study the volumes of the Journal of the Institute of Metals that so many new members are joining the Institute of Metals just now. They cannot readily get away to meetings of the Institute in war time, but they find all the papers that were read at the meetings recorded in the invaluable transactions, along with much additional information respecting the use and working of the non-ferrous metals and alloys.

STEEL CO. OF CANADA.

The Steel Company of Canada as a result of its increasing business, largely due to the big war orders it has received and the prospect for business after peace is arranged, is planning extensive additions to its plant. Three new open hearth furnaces are to be built at once, the blooming mill extended and two force shops erected for the manufacture of 8 and 9.2 shells. The improvements will cost several hundred thousands of dollars.

CANADIAN COAL AND COKE.

A despatch from Calgary, Alberta, announced that the largest foreclosure action ever taken in Western Canada had been commenced in the Supreme Court at Calgary. The Royal Trust Company, on behalf of the bondholders is asking for judgment for $3,000,000 against the Canadian Coal and Coke company. The Financial Times understands that this foreclosure proceeding is preliminary to the proposed re-organization.

SENECA-SUPERIOR DIVIDENDS.

The issued capital stock of this company is $478,884 and the dividends paid to date, together with that declared payable Dec. 15, makes a total of $981,212.20 or 205 per cent.

SPECIAL CORRESPONDENCE

BRITISH COLUMBIA

There is little change in the mining situation in the Province, except that in the placer-mining camps cold weather has compelled a cessation of gravel-washing and that in a few instances snow interferes with the operation of small mines, generally those at which there is danger of snowslides that make it unsafe to use trails while there is the risk of snow coming down at any time. Reports from the larger producing mines indicate that the output of ore is being well maintained and that the year's total of production will be fully as large as can be expected under conditions some of which have militated against the year proving as prosperous as would have been the case had there not been adverse conditions to affect the output of several of the mines in the first half of the year.

Cariboo

The placer-mining season closed in this district about the end of October. In the early spring the prospects for a sufficient water supply to admit of piping being continued until nearly the end of autumn were unfavorable, for the snowfall during the previous winter had been less than one-half of that of ordinary winters. However, summer and autumn rains were frequent and the result was that it was found practicable to continue hydraulicking until the near approach of winter. The placer mines operated were those known as the John Hopp properties, situated on Lowhee creek, Stout's gulch, and Mosquito creek, that of the Lightning Creek Hydraulic Mining Co., on Lightning Creek; and on Perkins gulch, Chisholm creek, Shepherd creek, Chinn creek and Slough creek, all in Cariboo mining division of Cariboo district. In addition much work was done in different parts of the division with Keystone drills, with the object of ascertaining as far as could be done by this means the average gold content of gravel beds which it is thought might be profitably dredged. Not much progress appears to have been made toward further developing a number of quartz properties on which work had been done intermittently over a long series of years, as yet, though, without production on commercially being established.

East Kootenay

Ore production at the Sullivan mine during five weeks ended November 25 was not up to the average of the previous sixteen weeks of the second half of the year, having been only 3,973 tons for the first-mentioned period, an average of about 795 tons a week as compared with 954 tons. However, there was an increase for the week ended November 25, the output having been 1,103 tons. The total quantity of Sullivan lead ore received at the smeltery at Trail during 47 weeks ended November 25 was 40,909 tons, against 36,784 tons for the whole of 1914. It now appears doubtful if the increase for the calendar year 1915 over that of 1914 will be more than 9,000 or 10,000 tons, or only one-half of the estimated increase as published in the Journal last month.

It is reported that a number of coal miners who had for some time been unemployed on Vancouver Island have been engaged to work in Crowsnest Pass coal mines. The total number of men from the coal mines of the latter district who enlisted for service in the European war has been placed at more than 500. If so comparatively large a number went from Crowsnest mines, it is not surprising that it has been found advisable to obtain miners from other parts.

West Kootenay

Ainsworth—It is reported that ore has been struck in a raise in the Gallagher mine, owned by Mr. A. D. Wheeler and being developed by Messrs. Beckett of Spokane, Wash. Announcement has been made that Mr. A. W. McCune, of Salt Lake City, Utah, has arranged for work to be done throughout the winter on a group of mineral claims in Ainsworth camp. Shipment of silver-lead ore from the No. 1 mine is being continued; the published figures of ore receipts at the Trail smeltery from this mine indicate an average output during six weeks ended November 25 of 147 tons a week. Although there has not been any production from the Highland mine this year, it is known that a good shoot of ore has been opened at a lower level than that on which ore was stoped before the commencement of the war and while the Highland concentrating mill was in operation up to the middle of the summer of 1915.

Interest in mining in the region of the South Fork of Kaslo creek is greater now than for several past years. It is regretted that owing to the insufficiency of the water supply the Cork-Province concentrating mill has been closed for the winter, but when the new water line is completed this obstacle to continuous operation will have been removed. The mining and concentration work of the 1915 season has demonstrated to the local company concerned that its undertaking can be continued with profitable results, so that the outlook is favorable for the prosecution of this enterprise with new vigor next spring. The bonding of the Mastiff group with option of purchase has been followed by inquiries for other properties in the neighborhood, and negotiations have been in progress for the sale of the Granite and Gray Eagle claims situated near the Flint mine, and for another South Fork property known as the Gibson group.

Woodbury creek, also in Ainsworth division, is now having the attention of Mr. Chas. F. Caldwell of Kaslo who was most persistent in his efforts to interest others in the Dixon mine, on Paddy mountain, until he succeeded in placing it on a basis that ensured its being properly operated. The Kaslo "Kootenaian" states that Mr. Caldwell has succeeded in making arrangements for the consolidation of a number of mineral properties on Woodbury creek, and quotes Mr. Caldwell in part as follows: "For years the mining properties of Woodbury creek region have lain idle because the prevalent ore of the district proved to be zinc and lead instead of lead only as one indicated by the surface outcrops. . . . With the recent extraordinary demand for zinc and the relatively high price it now brings in comparison with lead, attention has been turned to the Woodbury district. . . . I have succeeded in consolidating large holdings in that part and I now control 14 claims. . . . In developing the properties I shall be guided by the counsel of Mr. W. Yalen Williams, formerly in charge of the Granby Co.'s mines at Phoenix, Boundary district. The development work contemplated will consist of drifting 2,000 to 3,000 ft. north on the ledge and a similar distance south, which

will give a vertical depth of approximately 1,000 ft. at each face. Judging from surface indications this development should open orebodies that should give us many years' ore reserves. . . . . Assays taken from the different shafts, tunnels, and surface showings on the vein for two miles have given 50 to 57 per cent. zinc and about $10 to the ton in gold and silver, while the lead ores run 70 to 75 per cent. lead and also contain $2 in gold and 60 to 70 oz. silver to the ton.

Slocan.—Reports from the Lucky Jim mine are to the effect that with about a dozen men employed stoping, etc., an output of some 60 tons of ore a day is being maintained. The ore is shipped to the custom concentrating mill at Rosebery operated by Mr. J. P. Keane; a larger quantity will be milled daily as soon as the output of the mine shall be increased. Shipments of zinc concentrate from the mill to Kansas was commenced last month. Early in November ore was cut on the 912-ft. level of the Payne mine; a published report gives the width of the oreshoot as 2 ft. 6 in. and states that it contains lead and zinc in about equal proportions. A crosscut adit had been driven about 3,600 ft., this constituting what is known as the 1,500-ft. level, and a raise was made thence to the old 800-ft. level. Afterward a level was opened at 112 ft. below the old bottom level, and it was in driving to get under a winze sunk 34 ft. from the 800, and in which there was 2 ft. of ore, that the new find was made.

Between 3,000 and 4,000 tons of zinc concentrate has been shipped in recent months to United States reduction works from the Standard Silver-Lead Mining Co.'s concentrating mill at Silverton. Since shipment of silver-lead ore and concentrate was resumed last July approximately 4,000 tons of these products has been received at Trail from the Standard. Production has been commenced at the Galena Farm mine, situated a mile or two south from Silverton, and lead and zinc concentrates are being produced at the mill there. Another car of ore has been shipped to Trail from the Lucky Thought mine, on Four-mile creek, near Silverton; this property is being developed, under option of purchase, by the Consolidated Mining and Smelting Co. Several weeks ago it was reported that a strike of high-grade ore had been made on the Black Grouse claim, up the North Fork of Carpenter creek; recently a shipment of 11 tons of ore was made to Trail from that property, but no information has yet been received relative to its metal contents.

Nelson.—Additions to equipment at the Relief mill, in Erie camp, include a Dorr duplex classifier, a tube-mill 4 by 20 ft., a cyanide plant, and an 80-h.p. steam boiler as an auxiliary to the water-power hitherto used to drive the mill machinery. The treatment capacity of the stamp mill and gold-saving plant has been increased to 50 tons per diem. Mine equipment has also been added to. A raise from No. 4 level now connects with No. 3. Five stopes have been opened from No. 4 and two shifts are working in the mine.

The Jewel gold mine, in Boundary district, has been leased. The Skylarks, also in Greenwood mining division, is being worked under lease by local men who have been taking out ore. The Sally, near Beaverdell, West Fork of Kettle river, is again a shipper, with two lots of leasers at work taking out ore. The Carmi has lately been examined by an engineer sent in by prospective buyers resident in the United States.

In Similkameen valley, the Horn Silver is making an occasional carload shipment of ore of good grade. The discovery of molybdenite ore on claims in Olalla camp, Similkameen, is reported.

Three men have been employed since last July doing development work on the McKay group, on Adams river, in the northern part of Vancouver Island. A drift is being run on a showing of copper-gold ore, and it is intended to work throughout the winter unless prevented by too much water in the adit. The property is distant about 15 miles from tidewater on the eastern side of the island, and 25 miles from Quatsino on the western side. The work is being done under the direction of Mr. J. Cleveland Haas, of Spokane, Wash., for a syndicate of residents in that city.

NOVA SCOTIA

Dominion Coal Outputs—The output of the Glace Bay mines for November totaled 428,000 tons, showing an increase over the outputs of last November of no less than 132,000 tons. Nevertheless, the production was restricted by shortage of men to the extent of probably between 70,000 and 80,000 tons. December outputs will probably reach 400,000 tons, compared with 282,000 tons last year. If this is the case, the production for the year from the Glace Bay mines will reach 4,600,000 tons, or about 315,000 tons in excess of 1914 figures, and within 140,000 tons of the record production of 1913. The six months beginning October, 1914, and ending March 31st, 1915, was a very lean period, so far as coal production is concerned, so that comparisons with present rates of production show greatly to the advantage of the current period. It must not, however, be assumed that the mines are doing well when compared with previous output records. In the corresponding period of last year, outputs were restricted by lack of demand to about half production. At the present time the mines are working to the full capacity of the present force of workmen, yet the daily outputs are about 4,000 tons below normal full production.

COBALT

The remarkable briskness of the interest in the silver mines and prospects has already had much influence on the Cobalt camp. There are numerous inquiries for silver prospects and the market for shares of silver-producing companies has been even more active than of gold. In this advance there is something more than speculative value for every cent. advance in the price of silver is so much more profit to every mine producing. While ore shipments have shown a marked tendency to increase, such is the belief that silver will go much higher that shipments are not being rushed. However, those companies who were storing their silver in the confident belief of better days are now shipping at a normal rate, but no more than a normal rate.

Coniagas.—The news that the Coniagas Mining company has purchased the old Agaunico Cobalt mine on Lake Timiskaming is of more importance as a reminder of one of the old discoveries of the district than of any real importance. The Timiskaming Cobalt, as it was first known, was owned by Professor Van Hise and other American geologists. While it was in their possession they shipped some 88 tons of ore. This ore ran very high in Cobalt, but only a few ounces in silver. Later in the midst of the silver boom at Cobalt, a syn-

dicate of Chicago men bought the claims and named them the Agaunico mines. Very little mining was done and no shipments made, but the claims were widely misrepresented all over Canada and the United States. As a result the shares were sold all up and down the country. The property stands on the shore of Lake Timiskaming and is now the centre of a very successful dairy farm. There is still in place at the 50-foot level a vein of cobalt ore about a foot wide. At lower levels the vein was strong, but did not contain as much cobalt. Very little attempt was made to pick it up in crosscutting or drifting. It may be that the management of the Coniagas intend to mine and ship the cobalt ore, as there is now a steady market for the same; but it is much more likely that an effort will be made to discover better silver values by systematic development. The mine is not more than half a mile away from and is in the same formation as the Green-Meehan mine, where some remarkable blocks of high grade were taken out in the early days of the camp.

Ophir.—It is also reported that the Ophir-Cobalt will be started up again soon by the company itself. Short shoots of silver were found on the Ophir from time to time when it was developed, but development money ran out before enough of it could be blocked out to make profitable shipments.

Seneca-Superior.—A remarkable record for low costs is being made by the Seneca-Superior Mines. The following figures speak for themselves:

The operating costs for the past five months are as follows:

	Per ounce	Per ton.
June. . . .	096	$4.25
July.	.069	3.05
August.	.063	3.07
September. . . .	048	3.36
October.	.048	3.55

The dividend record of the company to December 15th, when the next disbursement is made, shows that there will have been distributed more than double their issued capital of $478,884. The dividend record is as follows:

Dividends paid.	Total.
1913	$310,774.60
1914.	335,218.80
1915.	239,442.00
December 15th, 1915	95,776.80
	$981,212.20

The cash on hand on November 20th was $180,000. In addition, payment has just been received for two cars amounting to $59,519.65, thus making a total balance of about $240,000 on or about November 20th.

Cobalt Comet.—The new vein found on the Cobalt Comet is proving up very well. This vein is about 200 ft. north of the house the late Dr. Drummond lived in when he was in the Cobalt camp. A shaft has been sunk on it and it has also been cut underground. As already described in the Canadian Mining Journal the vein was of solid niccolite and smaltite when first discovered in trenching and it was fully 10 inches wide. This solid vein carried several ounces in silver. At a depth of 20 ft., the character of the vein changed to the characteristic high grade silver-smaltite ore of the camp, running from four to five thousand ounces in silver. This shaft will be continued down and connection made from the cross-cut from the old workings. It is estimated that there should be an average of about 50 ft. of conglomerate along the 200 ft. of the vein. To the south the vein has been stripped for some distance and there are patches of very remarkable high grade silver ore. The ore is already being sacked. In other places in the old workings of the Comet the Kerr Lake management has met with good success. The Blue Jay vein is developing some tonnage of good milling rock and there are also short shoots of high grade. On the Hargraves boundary, from a winze in the Keewatin three tons of high grade ore has been mined and shipped. Since the beginning of the present month the shipping of mill rock from the Comet to the Dominion Reduction has been resumed.

Alexandra.—Mr. Sydney Smith and associates are running a drill on the old Alexandra under lease. This property adjoins the Bailey mine and it is hoped to pick up the Big Pete vein. Some years ago an ambitious scheme of development was outlined and a shaft carried to the 300 ft. level, but nothing of importance was found.

Foster.—From the Glen Lake Silver Mines, who are working the old Foster under lease, there has been shipped three tons of high grade ore to Messrs. Campbell and Deyell. This ore was taken from near the boundary of the Lawson. The main scheme of development on the Glen Lake is proceeding under the lake, the hope being that continuation of the ore shoots being mined by the Penn-Canadian or the Bailey will be found.

Chambers Ferland.—Some high grade ore has been found in a winze down to about 400 ft. from the Chambers-Ferland. This winze was sunk near the Nipissing line on a strong vein of niccolite and smaltite with a low silver content. This vein dipped out of the winze but when the winze was continued down vertically another vein was cut. It is not narrow and much broken up, but it is of high grade ore.

Poste.—An interesting discovery of native silver in golden has been made on the Poste claim in Montreal township, one thousand feet. It is about four and a half miles from the Dobie mine. There are quite large flakes of native silver in the quartz and it is understood there are fair values in gold.

Kerr Lake.—Pumping in order to get portion lower the mud in Kerr Lake has ceased entirely and is unnecessary. The [illegible] has been moved to dry land and will now be a permanent installation. It will be used only for pumping out the surface water which leaks in any into the bottom of the lake.

Silver Leaf.—In a car shipped to the Dominion Reduction Co. there was contained 45,000 ounces from the Silver Leaf. This was of high grade ore mined some time ago under lease by the Kerr Lake.

PORCUPINE, KIRKLAND LAKE, MUNRO TOWNSHIP and BOSTON CREEK

Croesus.—Although some difficulty has been experienced with faulting on the 100 ft. level of the Croesus Gold Mines in Munro township, there has already been developed an ore shoot of about 140 ft. on the 100 ft. level. The vein will run from six inches to two or three feet wide. There are occasional patches of the high grade ore which made the Dobie-Leyson property so famous earlier in the year, but the average grade across a stoping width is remarkable. Below the 100 ft. level the shaft was out of ore. The sub-level was good at 150 ft. and it is understood that the vein has been cut here. The incline shaft is now down close to the 200-ft. level, and it is confidently expected that with past experience in picking up the vein there will be no great difficulty in finding it at that depth.

of ore have been drilled and a few feet beyond the marked success has been obtained with the use of metal balls in the tube mills in the place of stone pebbles. It is estimated that when these balls are being used in all the tube mills that it will be possible to treat 300 more tons a day with the present equipment. This will mean that when the improvements inaugurated in the present mill are completed that it will be treating 700 more tons per day.

The Porcupine Vipond has cut its vein at the 500-ft. level. In the winze it shows as yet as a stringer of quartz, very rich, but quite narrow. A drift will at once be commenced on it. While the production at the Vipond continues to be rather low the development at the mine is most satisfactory. Development and stoping at the 300-ft. level particularly, has discovered reserves of ore which it was not at all anticipated

SWASTIKA MINE, ONTARIO. RECENTLY RE-OPENED

Munro Consolidated.—Since the hard weather came and the road has been passable, development on several nearby prospects has been resumed with great vigor. A discovery of some importance has been made on the old Leyson property, which is now incorporated under the title of the Munro Consolidated mines. Before the snow came two prospectors had located good veins in Bowman township, not far from the town of Matheson. These have been a little more prospected since and there is at least one free gold discovery of promise.

Hollinger.—The surface improvements on the Hollinger are now rapidly approaching completion. The most important of these from the mining point of view is the new head frame which will be of proportions not before attained at any mine in the North Country. The masonry upon which the head frame will be erected has been completed and the tender for the head frame has been let to the Dominion Bridge Co. But from the point of view of the ordinary passer-by the new office building is the more prominent. The structure of this building has now been completed. The directors' bungalow on the hill is also now roofed in and the main structure completed. It has also been found necessary to build a new transformer house. The new transformer is being built between the old office and the mill.

In the Hollinger mill itself, after some months' trial, would be found. Veins that were believed to be out point where development had been stopped, the vein has been picked up again much stronger and richer. It is now believed that at the lower levels the two main systems on the Davidson and the Godfrey will merge into one, since, as each successive level has been opened up, the gap of barren ground between these orebodies has steadily decreased.

McIntyre.—Development at the No. 5 shaft on the McIntyre continues to give lively satisfaction to the management. About 70 ft. to the south of the No. 5 shaft the Contact vein has been cut. It is between four and five feet wide and ore running between $10 and $11 to the ton. On the same orebody on the 600 ft. level drifting has been in progress for some time both ways. To the north the diamond drill is working and has picked up the No. 5 vein on lower levels.

The dewatering of the Jupiter shaft has commenced. It is believed that it will take about two weeks before the workings will be free of water and actual mining can commence. A rock-house will be established at the Jupiter and from it the ore will be teamed to the McIntyre mill, where it will be treated at a cost to the McIntyre-Jupiter mines of $2.00 a ton. A crosscut from the main shaft of the McIntyre will also be started along the Contact vein in the Jupiter ground at once.

The Pearl Lake shaft is now down to about 900 ft. Every effort will be made to put it down as fast as possible as it is to be used as the main working shaft of the McIntyre group. The structure of the addition to the McIntyre mill is now completed, but delivery of machinery may delay the time when it will be available for operation.

The Smith-La Bine claims at Sesekinika have been taken under a working option by Mr. Robert Livermore, manager of the Kerr Lake Mining Co. Work has already been commenced on them. Throughout the summer these claims have been sampled from time to time and always with satisfactory results. But there has always intervened to prevent the consummation of the deal, some undesirable factor. There is now little possibility that these promising claims will not receive adequate development.

Kirkland Lake.—A large amount of machinery is now being hauled over the winter road from Swastika to Kirkland Lake. This machinery is going to the Teck-Hughes property at Kirkland Lake and the La Belle gold mines at Good Fish. As soon as it has been installed more stimulus will be given to the underground operations of these two properties.

There has never since the early days of the Kirkland Lake rush been so much activity as now exists in this section of the Northern gold fields. There is an excellent demand for claims upon which gold has been discovered and which are within reasonable distance of producing mines.

NEWFOUNDLAND

Iron and Steel.—The transportation of iron ore from the mines at Bell Island to Sydney was discontinued about Dec. 1st, and shipping will not be resumed before April next. The amount of ore shipped from Bell Island to Sydney since the opening of navigation last spring was 600,000 tons. In addition to this several cargoes went to England and the States. Operations during the past season were most successful both industrially and financially. Though shipping of ore has ceased until next spring, there will be no let up at the mines. Both companies are working day and night and intend doing so all through the winter months, employing the largest possible number of men.

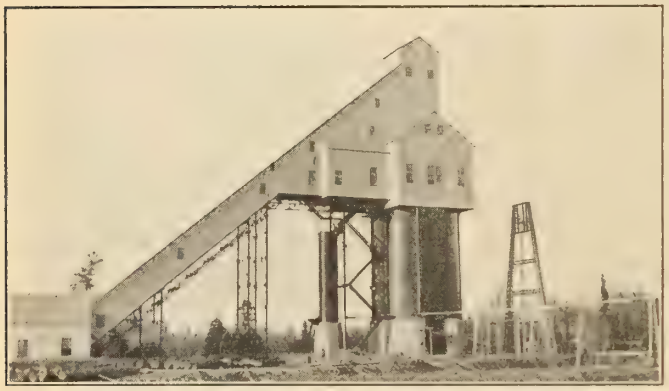
In conjunction with the mines at Bell Island, a large staff of workmen are working day and night on additional new open hearth furnaces at their Sydney smelting works. In order that the Dominion Iron and Steel Co., whose steel plant is at Sydney, may be in position to reap a large portion of the recent eight million dollar order for munitions given by the British Government, it was found necessary to increase their plant by additional blast furnaces. In the work of excavation for this work a record was made, and from data in my possession I am in a position to state that one of these furnaces will be the largest and most modern ever built, and will be finished and ready for operation in a shorter time than was formerly thought the work could be done. This furnace will turn out a particular steel for the manufacture of eight, nine and twelve inch shells, and larger if required. This furnace alone will have a capacity of over 200 tons per day. Last month the steel shipments from Sydney were the largest ever made, doubling the shipments of the previous month, but notwithstanding this large output, unfilled orders to the amount of 180,000 tons were obliged to remain over for this month. Every effort has been put forth by the Dominion Iron & Steel Co. and the Nova Scotia Steel Co. to keep pace with the increasing orders. Large numbers of the best available skilled mechanics have been added to the staff, and hundreds of miners and ordinary laborers have been added to the pay rolls, but still it was impossible to fill the orders. On the whole the outlook for the industrial workers in connection with the smelting and mining works at Sydney and Bell Island, Nfld., could not be brighter.

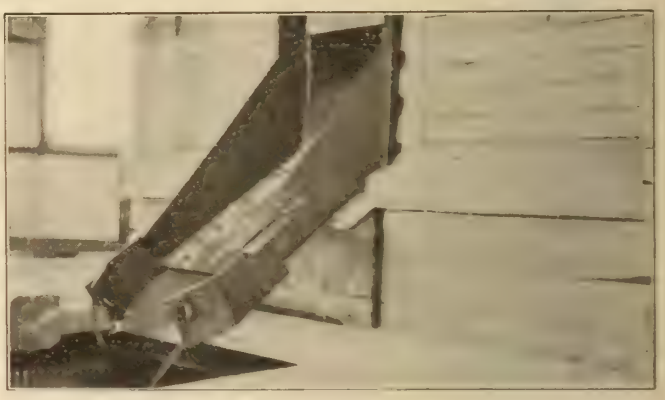
Copper.—Work on the different copper mines throughout the Island goes on steadily, and the output increases. Mr. MacKay's Syndicate, capitalized at $100,000, and known as the Hydro-Electric Smelting Co., has completed all arrangements for the erection of a copper smelter, on the south side of the harbor of St. John's. The company has purchased from Mathieson & Co., of London, the old copper mine at Little Bay in Twillingate district. The immense deposits of copper waste which were piled up during the years this mine was working, containing several hundred thousand tons, and considered in those days not worth handling, will at once be utilized by the company, and used to feed the smelter, and will thus be turned into commercial value. When this mine was in operation, 35 years ago, only the very best ore was shipped from there to Swansea, so that large piles of ore containing a great percentage of copper were thrown aside into waste dumps, which will now be used to considerable advantage. In the neighborhood of this mine is a large lake, into which thousands of tons of copper waste was thrown and the drainings from copper heaps thrown around have been flowing into this lake for years. Scrap iron taken from the water is found to contain thick coatings of copper. The Little Bay mine was worked very successfully and with considerable gains when copper was worth only seven cents per pound, so that the present owners may reasonably expect very profitable returns when copper is quoted at 20 cents per pound.

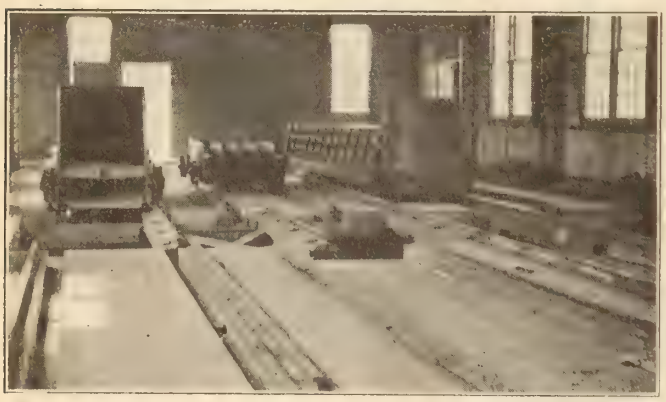
The Newfoundland Shell Co., Ltd. hope to be able to begin manufacturing shells at the beginning of the New Year. The capital stock of the company has been fully secured to the shareholders by Government guarantee. The par value of the shares is $50 each, and there remain only 500 more shares for subscription which will no doubt be all taken up during the week. The company is under contract with the Canadian Steel Committee to manufacture shells for the Imperial Government, and under terms which assure very profitable returns. It is pleasing to note that the copper and steel to be used in the making of these shells will be produced from the mines of Newfoundland, the copper being smelted here and the steel a product of the iron mines of Bell Island, which will be smelted and manufactured at Sydney, C.B.

Lead.—Very pleasing intelligence has been received of the formation of a company in Boston, Mass., for the purpose of working some of the fine galena deposits situated at Port-au-Port in the district of St. George's, west coast of Newfoundland. In many of the reports issued from time to time by the director of the Geological Survey, will be found very hopeful references to the possibility of this country containing large deposits of lead and silver. The deposits now about to be worked, in the district of St. George's, give as high as 84% of lead, with little or no silver.

QUINCY HILL, HOUGHTON, CO., MICHIGAN







ROCK-HOUSE SUGGESTIONS FROM MICHIGAN MINES

COPPER TO SWITZERLAND

Shipments of copper and other materials have been resumed to Switzerland, after being long cut off by the Entente powers, under an arrangement similar to the plan of the Netherlands Overseas Trust in Holland. A concern known as "S. S. S.," Swiss Surveillance Society," translated, has been organized under Government supervision and guarantees given that shipments consigned to it will remain in Switzerland. Plan became operative on Dec. 1, and already small shipments of copper have gone forward under this arrangement.

MICHIGAN COPPER OUTPUT.

Houghton, Mich., Dec. 3.—The Lake Superior copper mines produced over 25,000,000 pounds of refined copper in November. Ahmeek and Osceola showed the largest increase in output, the latter breaking all records sending 101,000 tons of rock to the mill. Osceola's increase came from South Kearsarge, that branch alone running as high as 4,000 tons daily. Wolverine showed a small decrease.

CALUMET AND HECLA.

According to the Boston News Bureau Calumet & Hecla will produce in 1916 about 65,000,000 pounds of copper, the best showing in three years. With its rock running 22 pounds of refined to the ton the cost may be estimated at 9½ cents per pound. In 1912, with production of 67,000,000 pounds and rock averaging 24.1 pounds per ton, cash cost 9.86 cents with the fraction representing construction expenditures.

On a basis of 18 cent copper Calumet & Hecla will earn about $5,000,000 from its own operations or say $55 per share, and the principal subsidiaries will earn $5,500,000, the Calumet equity in which is $2,250,000. This makes a total of $7,750,000, or $77.50 per share on Calumet & Hecla. The company will have paid $50 per share in dividends in 1915.

THE TUNNELING COMPANY.

Newspapers of Alberta and British Columbia recently published a notice sent out from Calgary, Alberta, as follows:

"Recruiting for No. 2 tunneling company of engineers, Canadian expeditionary force, will be started immediately with Calgary as the mobilization point.

'Miners and mine workers will largely compose this specialized unit, as a knowledge of tunneling in all

Mining Copper Ore, 68th level, Calumet and Hecla mines, Michigan

grounds, mining, timbering and the handling and firing of high explosive charges will be essential in those desiring to join. Various mining centres of Western Canada will therefore be visited and asked to contribute their quota.

"Major R. W. Gauthier, who is a mining engineer of 15 years' standing in Western Canada, will organize and command the company, which is a departure from previous military establishments in Canada and has been inaugurated to meet certain requests and requirements which have developed at the front.

"Further particulars concerning the recruiting [illegible] Calgary recruiting station, address [illegible] ment generally will be announced in a few days. Written applications for enlistment may be made to Major R. W. Gauthier at post office box 2317, Calgary, Alta. It is expected that this force will leave for overseas very soon after organization has been completed."

CITIZEN BLACK

Under the above caption the Post-Intelligencer, published in Seattle, State of Washington, on November 28 printed, among its editorials the following comment:

George Black, Governor of the British territory of the Yukon, concerned on the King's civil business on the outskirts of the Empire, felt that his country needed him more for defence than for civil government, so a few days ago he wired his resignation as Governor to Premier Borden of Canada, and will put on his uniform as a captain in the territorial forces and go to the front of war, in France. Men of the North, of Alaska and of the Yukon, who have known Black for so many years, will feel a thrill of pride in their friend's patriotic performance.

Long ago George Black showed his quality of manhood as one of the host of courageous, persistent men who braved the dangers and discomforts of the northern wilderness to establish civilization there. It is a democracy with no rank but manhood, and Black's title to membership was unquestioned. When deserved honor came to him the host of his fellow-pioneers were proud of his recognition. Now, when he has accomplished his reward and is secure in the fruits of his labor, at a time when his age would relieve him of military service, he lays down the honor of civil position to defend his country with his life, if need be.

It is a fine, a particularly fine and manly thing that George Black, man, Governor and soldier, has accomplished, and it will find recognition in a company not cribbed, cabined and confined by national boundaries—the great company of the manhood of all nations.

FIRE AT DRUMMOND MINE, N. S.

New Glasgow, N. S., Nov. 29.—Fire in the Drummond mine at Westville was discovered at 4 o'clock Sunday morning by Calder Russell and Fac. Smith, who had gone down to feed the horses, says the News. They encountered smoke at No. 13 lift. They tried to locate the fire and at 18 South level about 125 feet from the slope they discovered a door ablaze. They hastily returned to the surface and had an emergency call sent out for General Manager Maxwell, Mechanical Superintendent Richardson, Mine Manager Henderson and some other officials.

The officials went into the mine as quickly as possible. The first question which confronted them was as to whether the fire was concentrated at 18 south, or whether it extended to other parts or throughout the mine as well. Messrs. Maxwell and Henderson worked down below the fire into 19 but could not proceed any distance into the levels north or south owing to the heavy smoke.

The officials of the Acadia Coal Company having learned of the trouble in Westville, hurried to the scene of the trouble and rendered valuable assistance. The Draeger men were summoned and were gotten below as quickly as possible. They were able to penetrate the levels at 19 and found fire north and south.

With this information to work on General Manager Maxwell decided the best thing to do was to seal the mine. A stopping was built below No. 9, and the tunnel connecting Nos. 1 and 2 seams in the vicinity of No. 9 level was also sealed up. After this work had been accomplished all surface entrances to the mine at the main seam, second seam and No. 4 were sealed up and the fan stopped.

No lives were lost, but thirteen horses which were in the mine were lost. The horses in the Scott Pit and No. 4 were removed.

The cause of the fire is a mystery. Men were working in the vicinity of the fire on the night before and everything was safe within a few hours previous to the discovery, and it seems impossible that it could have resulted from spontaneous combustion. There are evidences on the slope between 17 and 18 which go to show that there was a slight explosion and it is supposed that this scattered the fire. The bells in the winding engine house rang about 3.30 for no apparent reason, and it is supposed that the explosion occurred at that time.

Various theories are offered as to the cause of the fire, and some of the miners around town hint at foul play. As a matter of fact nothing is as yet really known.

The town water has been turned into the mine, and the intention is to flood the fire district as speedily as possible. The whole Drummond Colliery is likely, however, to be shut down for some weeks to come.

Mr. Fergie, president of the company, and Mr. Patterson, vice-president, are expected to arrive from Montreal to-night.—Sydney Post.

CANADA FOUNDRY & FORGINGS, LTD.

New York—An officer of one of the large steel and iron companies in the middle West recently made an inspection of the plants of Canada Forge Co. and Canadian Billings and Spencer Co. at Welland, Ont. Both these companies are owned by Canada Foundries & Forgings, Ltd., and it is believed in certain quarters that the inspection may lead to change in control of corporation. Canada Foundries & Forgings, Ltd., has received two new contracts for shell forgings, which will necessitate further plant extension. Company is now turning out complete steel shell forgings at the rate of 12,000 per day. One new contract calls for 3,000 six-inch shells a day. The other is for 30-pound shells. Earnings are now estimated to be running at the rate of $200,000 a month, which is equal to almost 250% a year on outstanding $960,000 common stock. A large dividend distribution is looked for after the close of this year.

ANACONDA.

Boston—According to the News Bureau the Anaconda Copper Mining Co. is not only making sensational recoveries of metal values in the current flotation treatment of its ores and in the later smelting process, but it has also made equally striking developments in the leaching of its tailings. These tailings are now being leached with a loss of only 3½ pounds of copper per ton.

It is quite probable that soon after the first of the year President Ryan will address a statement to shareholders outlining in careful detail the extraordinary achievements of the past year or two in the company's metallurgical department. He may also say something concerning the company's big low grade copper property in South America and make reference to its entrance into the field of spelter production.

CANADIAN MINING AND EXPLORATION.

Directors of Canadian Mining & Exploration Co. have proved liquidation of the company. Assets of the company have all been liquidated. On receipt of proxy stockholders will receive their original investment in cash.

In addition to this it is expected liquidation will net stockholders between 5% and 7% per annum. Company has been in existence since May, 1912. On a basis of 5% a year, this would mean about 17½% above the original investment.

MR. SCHWAB TALKS AT PITTSBURGH.

Chas. M. Schwab in Pittsburgh last Wednesday said that the Bethlehem Steel Co. is not figuring in any manner with any steel company mergers, contrary to reports. He said that Pittsburgh and the United States are engulfed in a stream of prosperity and that already the United States is the dominant nation of the world, without waiting for the war to be over.

"What about the Bethlehem Steel Co. figuring in reports of steel company merger?" Mr. Schwab was asked.

"As far as I am concerned," was the answer, "no merger involving the Bethlehem Steel Co. is or has been in prospect. The company's organization is the same as it has been right along."

"What caused Bethlehem Steel stock to go to 600?

"I do not know the cause. I have been neither a buyer nor a seller of Bethlehem Steel Co.'s stock. I am not interested in the price of the stock on the market. I have just the same amount of Bethlehem Steel Stock as I have had for some time."

"Do you think that Pittsburgh and the United States are due for unprecedented prosperity?"

"They are having that prosperity now."

"What relation have the war orders to continued prosperity?"

"The war orders do not cut as big a figure, from a tonnage standpoint, as the world attributes to them. As far as tonnage is concerned, our export business is not extraordinarily big."

"Henry Ford is quoted as saying that he is willing to give his entire fortune to bring about peace. What do you think about that?" was asked of the man who makes the big guns that the allies are using.

"That is very commendable in Mr. Ford," said Schwab, smiling.

IRON AND STEEL.

Iron Age says: Transactions in Lake Superior iron ore are on verge of closing which, it is believed, will establish a price of $4.25 for Mesaba bessemer and $3.55 for Mesaba non-bessemer ore, an advance of 80 cents for the former and 70 cents for the latter on prices of this year. Old-range ores, according to present indications, will sell at an advance of about 75 cents over 1915 schedule instead of $1, as favored by some producers.

Difficulty of forcing pig iron production above the present rate appears in statistics for November. At 3,037,308 tons for last month, output was 101,244 tons a day, against 3,125,491 in October, or 100,822 tons a day. Steel company furnaces could not keep up the pace they made in the October strain for high records. Some may be expected to go out soon for relining, as the hard driving of many months is telling.

On December 1st the capacity of the 284 active blast furnaces was 103,033 tons a day, against 101,819 a day for 276 furnaces on November 1st, this last rate being based on the unusual outputs of October. Production is now at rate of 38,000,000 tons a year, allowing 400,000 tons for charcoal iron.

Iron markets in central West are showing little restraint in advances. At Chicago sales are numerous and readily closed at rising prices. In Ohio prices have gone up 50 cents to $1 on no large buying, but on the great extent to which producers find capacity taken up for first half.

In steel-making iron advances are readily made, bessemer having sold at $18.50 and $19 at furnace, while basic has brought as high as $18. For export $20 has been offered for bessemer.

DEMAND FOR IRON ORE.

Pittsburgh—Estimates continue to be made that to support comfortably present rate of pig iron production, fully 37,500,000 tons a year, there should be at least 60,000,000 tons of Lake Superior iron ore shipped next season. The maximum movement occurred in 1913, almost 50,000,000 tons. That proved to be too much, as pig iron production decreased, only 27,000,000 tons being made from July 1, 1913, to July 1, 1914. In 1914 shipments fell off almost one-third, but pig iron production decreased only one-seventh, and thus all or part of the surplus was absorbed. Production of pig iron up to the opening of navigation next year promises to be much in excess of the proportion that would be indicated by shipments in the season just closed, about 47,000,000 tons.

Doubts are expressed whether 60,000,000 tons of Lake Superior ore can be moved next season. Somewhat more than 50,000,000 tons of ore could have been moved in 1913, but the Lake fleet has since been reduced by smaller vessels going out for ocean trade, nearly all indeed that were short enough to go through the locks of the Welland Canal, and by losses from storms, while very few new boats have been built, and only a half dozen or so are to be completed for next season's use. The United States Steel Corporation apparently expected a shortage, as recently it chartered boats for next season to the extent of nearly 10,000,000 tons, and owners of the remaining boats are now indisposed to accept charters, preferring apparently to hold their capacity for high "wild" rates as the season progresses. Some ore interests are reported as negotiating to buy boats since they cannot charter them.

In the history of the Lake Superior ore trade for the past fifteen years or more, a vessel scarcity has hardly ever been threatened, there being usually ample carrying capacity for the ore that could be mined.

NOVA SCOTIA STEEL AND COAL CO.

The Nova Scotia Steel and Coal Company is rushing forward the construction of the additional plant to take care of the new orders received and the work is being carried out night and day with a view of completing it in record time. At the same time as the plants are being erected arrangements have also been completed for delivery of the necessary machinery.

SILVER PRICES

	New York cents.	London pence
November		
25	Holiday	30⅛
26	49	29
27	49⅛	29⅛
29	49⅝	29⅝
30	49⅝	29⅝
December		
1	49⅝	29⅝
2	49⅝	
3	49⅝	29⅝
4	49⅝	29⅝
6	49⅝	29⅝
7	49⅝	29⅝
8	49⅝	29⅝

MARKETS

NEW YORK MARKETS.

Dec. 8, 1915—Connellsville coke (f.o.b. ovens)—
Furnace coke, prompt, $2.15 to $2.25 per ton.
Foundry coke, prompt, $3.00 to $3.25 per ton.
Straits Tin, 37.25 cents.
Copper—
Prime Lake, 19.37½ to 19.62½ cents.
Electrolytic, 19.25 to 19.50 cents.
Casting, 18.75 to 19.00 cents.
Lead, Trust price, 5.25 cents.
Lead, outside, 5.25 cents.
Spelter, prompt Western shipment, 14.92½ to 15.42½ cents.
Antimony—
English brands, nominal.
Chinese and Japanese, 39.00 to 39.50 cents.
American, 39.00 to 39.50 cents.
Aluminum—
Virgin, 99 per cent., 58.00 to 59.00 cents.
Pure, 98 to 99 per cent., 56.00 to 58.00 cents.
Remelted No. 12 alloy, 48.00 to 50.00 cents.
Nickel, 45.00 to 50.00 cents.
Cadmium, nominal, $1.25 to $1.50.
Quicksilver, $125 to $130.
Platinum, nominal, $85.00 to $100.00.
Cobalt (metallic), $1.25.
Silver (official), 55¾ cents.

Metal Products.—Owing to the withdrawal of all price lists by the leading manufacturers of brass and copper products, quotations appearing below are based on the outside market and are likely to change at any moment. All prices are nominal as follows:

Sheet copper, base 25.00 cents.
Copper wire, base, 20.75 to 21.00 cents.
High sheet brass, base, 27.00 to 27.50 cents
Seamless brass tubing, 31.00 cents.
Brazed tubing, 31.50 cents.
Seamless copper tubing, 29.50 cents.
Brass wire, 27.00 to 27.50 cents.
Brass rods, 27.00 to 27.50 cents.
Sheet zinc, f.o.b. smelter, 22.00 cents.

STOCK QUOTATIONS.

(Courtesy of J. P. Bickell & Co., Toronto.)

New York Curb.	Bid.	Asked.
Atlanta	23.00	25.00
Canada Copper	2.06¼	2.18¾
American Marconi	362.50	387.50
Canadian Marconi	100.00	200.00
Belmont	4.50	4.62½
Braden	15.87½	16.00
Goldfield Cons.	1.18¾	1.25
Jim Butler	1.06¼	1.12½
Jumbo Extension	1.18¾	1.25
Riker Hegeman	5.25	5.50
Standard Silver-Lead, B.C.	1.87½	2.00
Stewart Mining	.56⅛	.62½
Tonopah Extension	4.00	4.06¼
Tonopah Mining	6.87½	7.12½
United Profit Shar.	187.50	193.75
Victor Oil	3.00	3.25
West End. Cons.	.83	.85
Yukon Gold	2.75	3.00
Anglo Amn. Oil	18.00	18.50
Standard Motors	9.75	10.25
Submarine Corp.	46.50	46.75
Kennecott Copper	53.50	53.75
Maxim Munitions	13.62½	13.87½
Int. Marine	16.62½	16.87½
Do. pref.	64.25	64.50
Standard Oil of N. Y.	215.00	218.00
Standard Oil of N. J.	505.00	508.00
Standard Oil (old)	1625.00	....
Standard Oil (subs)	1120.50	....

Porcupine Stocks.	Bid.	Asked.
Apex.	.05¾	.05⅞
Dome Extension	.33	.34½
Dome Lake	.23	.24
Dome Mines	28.50	29.00
Eldorado.	.00¼	.00½
Foley O'Brien	....	.58
Hollinger.	29.00	29.50
Jupiter.	.19½	.20
McIntyre	1.01	1.02
Moneta.	.09½	.09¾
Plenaurum.	.78	.80
Porcupine Imperial	.05	.05¼
Porcupine Crown	.91	....
Preston East Dome	.06¾	.06⅞
Dome Consol	.20	.21
Gold Reef	....	.02
Homestake.	.24	.30
McIntyre Ext.	32½	.33
Porcupine Vipond	.78	.79
West Dome	.16¾	.17

Cobalt Stocks.	Bid.	Asked.
Bailey.	.04⅞	.05
Beaver	47½	48
Buffalo	1.05	
Chambers Ferland	25¼	25½
Coniagas.	....	5.00
Crown Reserve	.63	.65
Foster.	.07	.08½
Gifford.	.04	.05
Gould	.00½	.00¾
Great Northern	.05	.05⅛
Hargraves	.02⅝	.03
Hudson Bay	23.00	
Kerr Lake	4.50	5.00
La Rose	.69	.70
McKinley	.65	.70
Nipissing	7.50	7.75
Peterson Lake	.36	.36¼
Right of Way	.04	.05
Silver Leaf	.03	.03¼
Teck Hughes	.14	.15
Temiskaming	.67½	.68
Trethewey	.17	.18
Wettlaufer	.08½	.09
Seneca Superior	....	.75
York Ontario	.01	.01¼
Ophir.	.10	.11
Shamrock Cons.	.19¾	.20
Adanac	.24	.25

TORONTO MARKETS.

Dec. 13, 1915—(Quotations from Canada Metal Co., Toronto)
Spelter, 21 cents per lb.
Lead, 6¾ cents per lb.
Tin, 42 cents per lb.
Antimony, 48 cents per lb.
Copper casting, 20¾ cents per lb.
Electrolytic, 20¾ cents per lb.
Ingot brass, yellow, 13c.; red, 15 cents per lb.
Dec. 13, 1915—(Quotations from Elias Rogers Co., Toronto)
Coal, anthracite, $7.75 per ton.
Coal, bituminous, $5.25 per ton.

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

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NEW BRUNSWICK and NOVA SCOTIA
Memoir 60. Arisaig-Antigonish District, Nova Scotia, by M. Y. Williams.
Memoir 78. Wabana Iron Ore of Newfoundland, by A. O. Hayes.
QUEBEC
Memoir 64. Preliminary Report on the Clay and Shale Deposits of the Province of Quebec, by J. Keele.
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Museum Bulletin No. 8. The Huronian Formations of Timiskaming Region, Canada, by W. H. Collins.
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YUKON AND NORTH-WEST TERRITORIES
Memoir 50. Upper White River District, Yukon, by D. D. Cairnes.

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Map 122A. Upper White River District, Yukon Territory. Topography.

Applicants for publications not listed above should mention the precise area concerning which information is desired.

Maps published within recent years may be had, printed on linen, at the nominal cost of ten cents each.

The Geological Survey will under certain limitations, give information and advice upon subjects relating to general and economic geology. Mineral and rock specimens, when accompanied by definite statements of localities, will be examined and their nature reported upon. Letters and samples that are of a Departmental nature, addressed to the Director, may be Mailed O.H.M.S. free of postage.

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Northern Canada Supply Co.

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C. L. Constant Co.

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Peacock Bros.

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Mussens, Ltd.

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Dominion Bridge Co.
Mussens, Ltd.

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Dodge Mfg. Co., Ltd.

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Mussens, Ltd.
Northern Canada Supply Co.
Jones & Glassco
Federal Engineering Co.
Can. H. W. Johns-Manville Co.
Dodge Mfg. Co., Ltd.

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Can. Ingersoll-Rand Co., Ltd.
Curtis & Harvey (Canada) Ltd.
Mussens, Ltd.
Northern Canada Supply Co.
Canadian Explosives, Limited

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Mussens, Ltd.
Northern Canada Supply Co.

Boilers—
Mussens, Ltd.
Fraser & Chalmers of Canada, Limited.
Peacock Bros.
Northern Canada Supply Co.
Can. Ingersoll-Rand Co., Ltd

Boots—
Dodge Mfg. Co., Ltd.

Buckets—
Hendrick Mfg. Co.
M. Beatty & Sons, Ltd.
Mussens, Ltd.
Northern Canada Supply Co.

Buildings—Steel Frame—
Dominion Bridge Co.

Cable — Aerial and Underground—
Mussens, Ltd.
Fraser & Chalmers of Canada, Ltd.
Northern Canada Supply Co.

Cableways—
Fraser & Chalmers of Canada, Limited.
M. Beatty & Sons, Ltd.
Mussens, Ltd.

Cages—
Mussens, Ltd.
Fraser & Chalmers of Canada, Limited.
Jeffrey Mfg. Co.
Northern Canada Supply Co

Cables—Wire—
Northern Electric Co., Ltd.
Standard Underground Cable Co. of Canada, Ltd.

Carbon (Black Diamonds and Bortz)—
Abe. Levine.

Cars—
Jeffrey Mfg. Co.
Mussens, Ltd.
Northern Canada Supply Co.

Car Pullers—
Dodge Mfg. Co., Ltd.

Cement Machinery—
Northern Canada Supply Co.
Peacock Bros.

Chains—
Jeffrey Mfg. Co.
Peacock Bros.
Jones & Glassco
Mussens, Ltd.
Northern Canada Supply Co.
Dodge Mfg. Co., Ltd.
B. Greening Wire Co., Ltd.

Chain Blocks—
Mussens, Ltd.

Chemists
Canadian Laboratories.
Campbell & Deyell.
Thos Heys & Sons.
Milton Hersey Co.
Ledoux & Co.

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Nova Scotia Steel & Coal Co.

Coal Cutters—
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Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.
Peacock Bros.
Mussens, Ltd.

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Canadian Explosives, Limited

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Fraser & Chalmers of Canada, Limited.
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Can. Ingersoll-Rand Co., Ltd.
Mussens, Ltd.

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Mussens, Ltd.
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Peacock Bros.

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Mussens, Ltd.

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Mussens, Ltd.
Boving & Co. of Canada, Ltd.

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Mussens, Ltd.
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Sullivan Machinery Co.
Peacock Bros.
Northern Canada Supply Co.

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Standard Diamond Drill Co.

Drills—Diamond—
American Diamond Rock Drills.
Sullivan Machinery Co.
Northern Canada Supply Co.

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Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.
Mussens, Ltd.

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Sullivan Machinery Co
Mussens, Ltd.

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Can. Ingersoll-Rand Co., Ltd.

Dynamite—
Curtis & Harvey (Canada), Ltd.
Canadian Explosives.
Northern Canada Supply Co.

Dynamos—
Northern Electric Co., Ltd.

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Mussens, Ltd.

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Peacock Bros.
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Northern Canada Supply Co.

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M. Beatty & Sons.
Sullivan Machinery Co.
Northern Canada Supply Co
Mussens, Ltd.
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Smart-Turner Machine Co.
Peacock Bros.

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Mussens, Ltd.
Alex. Fleck.
Sullivan Machinery Co.
Smart-Turner Machine Co
Peacock Bros.

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Can. Ingersoll-Rand Co., Ltd

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Mussens, Ltd.

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Dodge Mfg. Co., Ltd

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Mussens, Ltd.
Northern Canada Supply Co Ltd.

Forging—
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Smart-Turner Machine Co
Peacock Bros
Boving & Co. of Canada, Ltd

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Mussens, Ltd.

Furnaces—Electric—
Boving & Co. of Canada, Ltd.

Fuse—
Peacock Bros.
Curtis & Harvey (Canada), Ltd.
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Northern Canada Supply Co.
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Northern Electric Co., Ltd.
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Grease Cups—
Dodge Mfg. Co., Ltd.

Hangers—Cable—
Northern Electric Co., Ltd.
Standard Underground Cable Co. of Canada, Ltd.
Dodge Mfg. Co., Ltd.

Hand Hoists—
Boving & Co. of Canada, Ltd.
Fraser & Chalmers of Canada, Limited

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Mussens, Ltd.
Peacock Bros.

High Speed Steel Twist Drills—
Mussens, Ltd.
Northern Canada Supply Co.

Hoists—Air, Electric and Steam—
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Peacock Bros.
Mussens, Ltd.
S. Flory Mfg. Co.
Jones & Glassco.
M. Beatty & Sons
Fraser & Chalmers of Canada, Limited
Northern Canada Supply Co.

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Mussens, Ltd.
Sullivan Machinery Co.
Fraser & Chalmers of Canada, Limited
Can. Ingersoll-Rand Co.
M. Beatty & Sons.

Hoists—Gas and Gasoline—
Mussens, Ltd.

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Mussens, Ltd.
Northern Canada Supply Co.

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Mussens, Ltd.
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.

Jigs—
Mussens, Ltd.
Roberts & Schaefer Co.

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Mussens, Ltd.
Northern Canada Supply Co.

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Mussens, Ltd.
Canadian Explosives.
Peacock Bros.

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Northern Canada Supply Co
Jones & Glassco.

Locomotives—Electric—
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Jeffrey Mfg. Co.

Locomotives—Steam—
Mussens, Ltd.

Metal Merchants—
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Geo. G. Blackwell, Sons & Co.
Consolidated Mining and Smelting Co. of Canada.
Canada Metal Co.
C. L. Constant Co.

Monel Metal—
International Nickel Co.

Motors—
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Northern Electric Co., Ltd.
Peacock Bros.

Mule Stands—
Dodge Mfg. Co., Ltd.

Nickel—
International Nickel Co.

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Ledoux & Co.
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Geo. G. Blackwell.
Consolidated Mining and Smelting Co. of Canada.
Orford Copper Co.
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Fraser & Chalmers of Canada, Limited
Northern Canada Supply Co.
Hendrick Mfg. Co.

Pick Machines—
Sullivan Machinery Co.

Picks—Steel—
Mussens, Ltd.
Thos. & Wm. Smith.
Peacock Bros.

Pillow Blocks—
Dodge Mfg. Co., Ltd.

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Consolidated M. & S. Co.
Peacock Bros.
Mussens, Ltd.
Northern Canada Supply Co.
Smart-Turner Machine Co.

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Mussens, Ltd.
Northern Canada Supply Co

Pneumatic Tools—
Can. Ingersoll-Rand Co., Ltd
Jones & Glassco.

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Mussens, Ltd.

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Mussens, Ltd.
Fraser & Chalmers of Canada, Limited

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Dodge Mfg. Co., Ltd.

Pulleys, Shafting and Hangings—
Fraser & Chalmers of Canada, Limited
Northern Canada Supply Co.
Dodge Mfg. Co., Ltd.

Pumps—Boiler Feed—
Smart-Turner Machine Co.
Boving & Co. of Canada, Ltd.
Mussens, Ltd.
Northern Canada Supply Co.
Peacock Bros.
Canadian Ingersoll-Rand Co. Ltd.
Fraser & Chalmers of Canada, Limited

Pumps—Centrifugal—
Boving & Co. of Canada, Ltd
Mussens, Ltd.
Smart-Turner Machine Co.
Peacock Bros.
Thos. & Wm. Smith
M. Beatty & Sons
Can. Ingersoll-Rand Co., Ltd
Fraser & Chalmers of Canada, Limited

Pumps—Electric—
Smart-Turner Machine Co.
Boving & Co. of Canada, Ltd.
Mussens, Ltd.
Canadian Ingersoll Rand Co., Ltd.
Fraser & Chalmers of Canada, Limited

Pumps—Pneumatic—
Mussens, Ltd.
Smart-Turner Machine Co.
Can. Ingersoll-Rand Co., Ltd

Pumps—Steam—
Can. Ingersoll-Rand Co., Ltd
Mussens, Ltd.
Thos. & Wm. Smith.
Northern Canada Supply Co.
Smart-Turner Machine Co.

Pumps—Turbine—
Smart-Turner Machine Co.
Boving & Co. of Canada, Ltd.
Mussens, Ltd.
Canadian Ingersoll-Rand Co., Ltd.
Fraser & Chalmers of Canada, Limited

Pumps—Vacuum—
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Mussens, Ltd.
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Rope Blocks—
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Rope Wheels—
Dodge Mfg. Co., Ltd.

Rope Dressing—
Dodge Mfg. Co., Ltd.

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Mussens, Ltd
Peacock Bros.
Northern Canada Supply Co.
Allan, Whyte & Co.
Thos. & Wm. Smith, Ltd.

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B. Greening Wire Co., Ltd.
Allan, Whyte & Co.
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Thos. & Wm. Smith.
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Mussens, Ltd.

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Milton Hessey Co
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Jeffrey Mfg. Co.
Northern Canada Supply Co.
Peacock Bros.
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Dodge Mfg. Co., Ltd

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Fraser & Chalmers of Canada, Limited

Turbines—Water—
Boving & Co. of Canada, Ltd

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Canadian Ingersoll-Rand Co., Ltd.

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B. Greening Wire Co., Ltd

Wire (Bare and Insulated)—
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Northern Electric Co., Ltd
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Peacock Bros.

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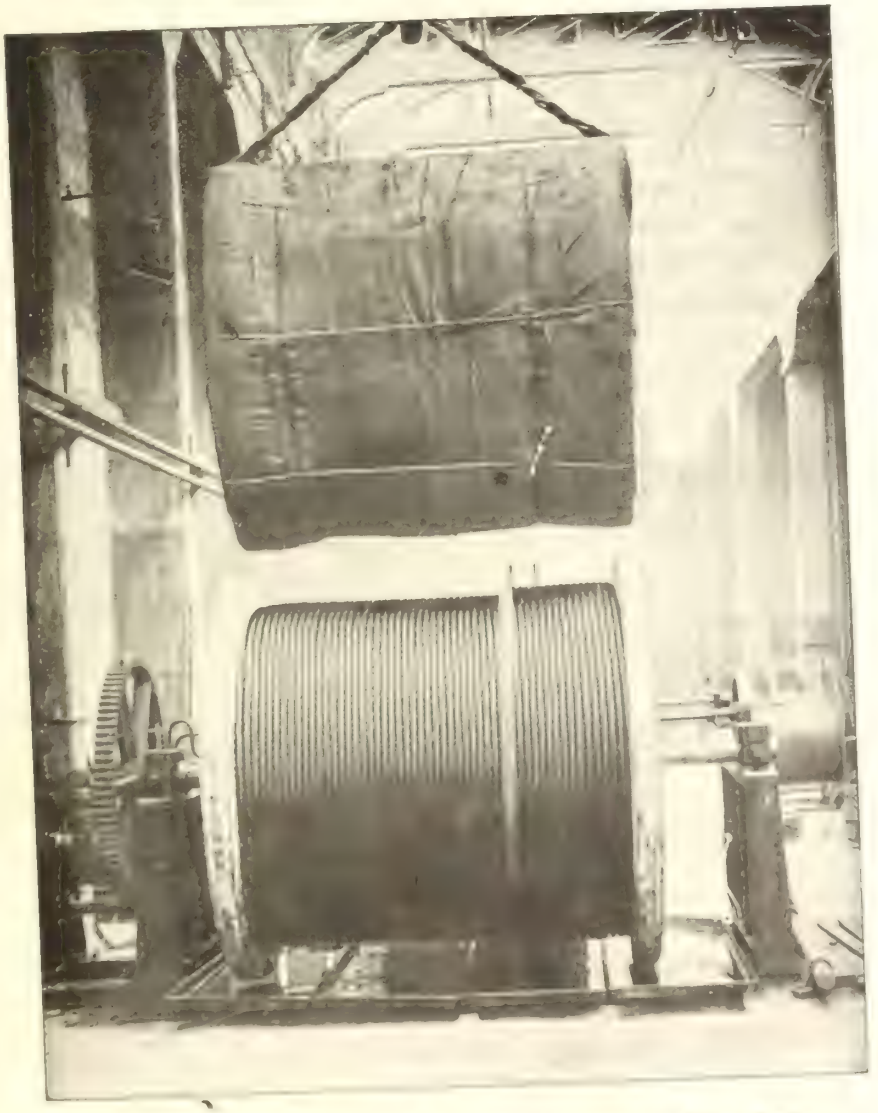

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